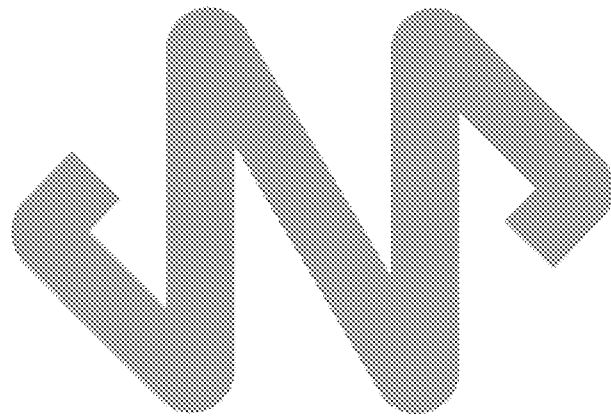




J N P G R O U P

CONSULTING ENGINEERS

Flood Risk Assessment

Project: Land West of Arundel Road,
Angmering

Client: Redrow Homes

Reference: C86473-JNP-92-XX-RP-C-2002 P05

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FOR AND ON BEHALF OF JNP GROUP

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1 INTRODUCTION

1.1 Terms of Reference

1.1.1 JNP Group has been commissioned by Redrow Homes to prepare a flood risk assessment for the proposed residential development to the west of Arundel Road in Angmering, West Sussex.

1.1.2 This report assesses flood risk at the development site from all potential sources and describes the measures adopted in the master planning process to manage such risks. It has been prepared in compliance with current policies and best practices.

1.2 Policy Framework and Key Stakeholders

1.2.1 The *National Planning Policy Framework* (NPPF) (February 2019) sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Where these tests are not met, national policy is clear that new development should not be allowed.

1.2.2 In areas at risk of flooding or for sites of one hectare (ha) or more, developers must undertake a site-specific flood risk assessment to accompany applications for planning permission (or prior approval for certain types of permitted development).

1.2.3 In decision-taking, local planning authorities must ensure a sequential approach to site selection and master planning is followed so that development is, as far as reasonably possible, located where the risk of flooding (from all sources) is lowest, taking account of climate change and the vulnerability of future uses to flood risk.

1.2.4 Where development needs to be in locations where there is a risk of flooding, local planning authorities and developers must ensure development is appropriately flood resilient and resistant, safe for its users for the development's lifetime, and will not increase flood risk elsewhere.

1.2.5 The Environment Agency (EA) is a statutory consultee on applications where there is a risk of flooding from the sea or main rivers.

1.2.6 Lead local flood authorities (unitary authorities or county councils) are responsible for managing local flood risk from ordinary watercourses, surface water or groundwater, and for preparing local flood risk management strategies. Local planning authorities work with lead local flood authorities to ensure local planning policies are compatible with the local flood risk management strategy.

1.2.7 West Sussex County Council (WSCC) is the lead local flood authority (LLFA) and its strategy for managing local flood risk is set out in Local Flood Risk Management Strategy (2013) and 'Water. People. Places. A guide for master planning sustainable drainage into developments' (2013).

1.2.8 Arun District Council (ADC) is the local planning authority (LPA) and its policies on flood risk management are set out in Local Plan Local Plan 2011 – 2031.

1.2.9 Where relevant, local planning authorities and developers must also take advice from:

- Internal drainage boards; to identify the scope of their interests.
- Sewerage undertakers; to ensure they can assess the impact of new development on their assets and plan any required improvements. Southern Water (SW) is the local sewerage undertaker.
- Reservoir undertakers; to avoid an intensification of development within areas at risk from reservoir failure and ensure they can assess the cost implications of any reservoir safety improvements required due to change in land use downstream of their assets.
- Navigation authorities; in relation to developments adjacent to, or which discharge into, canals (especially where these are impounded above natural ground level).

1.3 Sources of Information

1.3.1 This flood risk assessment has been based on the following sources of information:

- Bespoke topographic survey undertaken by SubVision Surveys Ltd (Ref. SS-RED-001, February 2021);
- British Geological Survey's *Geoindex Tool*;
(<http://mapapps2.bgs.ac.uk/geoindex/home.html>)
- DEFRA / EA's aquifer and source protection data
(<https://monit.defra.gov.uk/MonitMap.aspx>)
- EA's Flood Map for Planning;
(<https://flood-map-for-planning.service.gov.uk/>)
- EA's Long Term Flood Risk Information;
(<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)
- WSCC's Preliminary Flood Risk Assessment Volume II, Technical Report (2011)
- WSCC's Strategic Flood Risk Assessment Volume II, Technical Report (2010);
- Water. People. Places. A guide for master planning sustainable drainage into developments – LLFAs of the South East of England and AECOM, (2013);
- ADC's Strategic Flood Risk Assessment (2016);
- Land off Arundel Road, Angmering - Flood Risk Assessment & Outline Surface Water Drainage Strategy, 881292-R3(00)-FRA (2019).
- E&P Groundwater Monitoring Results

2.1 Location

Table 2.1: Site Location

OS K	OS Y	Area (ha)	Nearest Postcode
506554	105259	9.1	BN16 4DN

An aerial photograph of the Angmering area. A white line outlines a 'Site Boundary' in the center-left. The road 'A27' runs horizontally across the top, and 'A280' runs horizontally across the bottom right. The area is a mix of built-up structures and open land.

2.1.3 The surrounding land uses are summarised in the following table.

Direction	Land Use
North	Steyne Woods
East	Nine new houses, Arundel Road, woods and arable land beyond.
South	Angmering Recreation Ground
West	Arable farmland

2.2 Topography

- 2.2.1 The available topographic information (Appendix A) shows that ground levels within the development site range between 23.0 m above Ordnance Datum (aOD) adjacent to Arundel Road in the north east and 11.0m aOD in the north west.

2.3 Hydrology

- 2.3.1 An unnamed watercourse is located c. 70m to the north of the site, flowing north east to west. From the Ordnance Survey map, this appears to rise from a spring just to the north of the A27, but the alignment is also an overland flow route to the north east of the spring.
- 2.3.2 The watercourse discharges into ponds (named Decoy ponds) to the north west of the site, which in turn flow into the Black Ditch and ultimately the River Arun.
- 2.3.3 A ditch is located along the western site boundary. The northern part of this falls towards the unnamed watercourse. The part of the ditch near the south western corner of the site is understood to connect to a ditch to the west via a culvert, with this ultimately discharging to downstream watercourses.

2.4 Geology

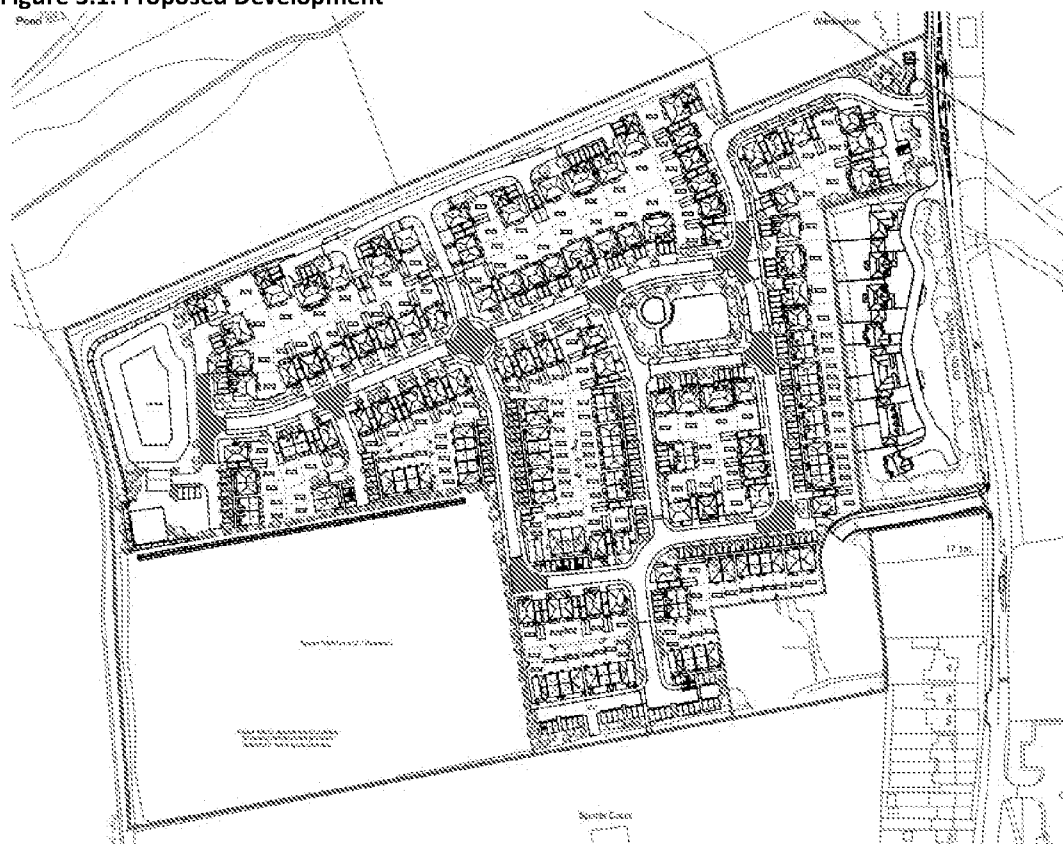
- 2.4.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online Geoindex Tool
<http://mapapps2.bgs.ac.uk/geoindex/home.html>
- 2.4.2 No artificial or Made Ground is indicated to be present underlying the site. The superficial geology of the site to be is indicated to be Head deposits, which underlie all but the north east of the site and are described by the BGS as *“poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep”*.
- 2.4.3 The underlying geology is indicated to be the London Clay Formation, which is part of a syncline orientated north west to south east with the axis just to the north of the site. The outcrop of the underlying clays, silts and sands of the Lambeth Group is just off-site to the north.
- 2.4.4 There are no faults denoted within 500 m of the site.
- 2.4.5 JNP Group have consulted online borehole records held by the BGS. There are borehole records c. 500m to the west, albeit on the outcrop of the Lambeth group so slightly lower in the geological sequence. These boreholes are used for groundwater abstraction from the Chalk which underlies the Lambeth group. The borehole logs indicate 30m of Lambeth group above the Chalk indicating that there be at least this thickness beneath the site.
- 2.4.6 The RSK report includes the results of infiltration testing. This was undertaken in four trial pits excavated to between 1.8m and 2.5m bgl. The strata encountered was clays classified as head deposits or London Clay. The pits were dry. Infiltration did not occur in three pits and a very low rate of 6.7×10^{-7} m/s was determined from the testing the fourth pit.

- 2.4.7 EA Aquifer Maps indicate that the Head deposits are classified as a Secondary (Undifferentiated) Aquifer, the London Clay is not classified and the Lambeth group as a secondary A Aquifer.
- 2.4.8 The Environment Agency define a Principal Aquifer as:
- “These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.”*
- 2.4.9 The Environment Agency define a Secondary-A Aquifer as:
- “Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.”*
- 2.4.10 The site’s proximity to groundwater Source Protection Zones (SPZs) was determined by reference to the EA’s website. The site is not located within or close to a SPZ. Based on the available geological and hydrogeological information, infiltration drainage is deemed unfeasible at the development site.

3 PROPOSED DEVELOPMENT

- 3.1.1 The proposed development (Figure 3.1 and Appendix B) comprises approximately 156 residential properties with associated hard paved / impermeable surfaces (e.g. roofs, roads, driveways, parking areas, etc.), public open space and a SUDS basin. The impermeable area totals approximately 3.65ha, including a 10% allowance for urban creep of the residential dwellings.
- 3.1.2 Under Table 2 of the *Flood Risk and Coastal Change Guidance* (March 2014), the proposed residential development is classified as more vulnerable.

Figure 3.1: Proposed Development



4 FLOOD RISK ASSESSMENT

4.1 Overview

- 4.1.1 All potential sources of flood risk at the development site have been assessed based on the information listed in Section 1.3 and are summarised in Table 4.1. The key sources of flood risk to the proposed development are further described in the ensuing sections.

Table 4.1: Potential Sources of Flood Risk

Source	Flood Risk
Coastal	No risk, site 10m + aOD
Fluvial	Site Flood Zone 1 – low risk. ADC SFRA indicates site will still be FZ1 when climate change is considered.
Surface Water	Very low risk predicted across site, small discrete areas at higher risk associated with ditch along western boundary. Increased surface water flood risk resulting from development will be mitigated by drainage strategy.
Groundwater	Winter groundwater monitoring found a perched water table in the Head Deposits. Considered Low risk after further SI advice. However, the perched water table needs to be considered in the designs. See section 4.3.
Sewers	ADC SFRA indicates only two reported incidents in BN16 4 postcode. Pre-development private sewer system on site to septic tank in SW of developed area. System will be replaced during development. Low risk.
Infrastructure Failure	Very low risk

4.2 Climate Change

- 4.2.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account.
- 4.2.2 In accordance with the EA's guidance Flood Risk Assessment: Climate Change Allowances (July 2021), the proposed development with anticipated life span into the 2080's (2070 to 2115) must take account of the following allowances:

- Peak River Flows (Southern river basin district)
 - * Central..... 25%
- Peak Rainfall Intensity
 - * Upper End 45%

4.3 Groundwater Flood Risk

4.3.1 Groundwater flooding occurs when the level of water filling the pores and / or cracks in the underlying soil and / or rock (i.e. water table) rises and emerges on the surface. The level of the water table varies seasonally and depends upon long term rainfall, thickness and porosity of the underlying strata and groundwater abstraction.

4.3.2 Groundwater flooding is most common in areas where the underlying bedrock and superficial deposits are very porous, but it can also happen at locations where superficial layers of sand or gravel overlay impermeable bedrock.

4.3.3 Groundwater flooding usually occurs after days or weeks of prolonged rainfall and often lasts for days or weeks, as subsiding of the water table can be a very slow process.

4.3.4 Besides posing a direct flood risk to developments (particularly basements), high water table levels can exacerbate other sources of flood risk by preventing infiltration and / or leaking into drainage systems.

4.3.5 The ground water monitoring undertaken by Eastwood & Partners in March 21 to February 22 encountered groundwater on average 0.6-0.7m bgl across the site. This is understood to be perched groundwater in the Head Deposits. The Site Investigation team concluded that:

"Based on the groundwater monitoring results, it is likely that the water present within the monitoring wells represents a perched water table within the Head Deposits. These superficial deposits are present across the site and the base of this strata was not encountered in any of the exploratory holes, the deepest of which reached 6.45 m bgl. The solid geology underlying the Head Deposits is the London Clay Formation. The true groundwater level is likely to be present within the solid geology at depth, with the Head Deposits containing perched groundwater sat over the relatively impermeable London Clay.

The gas monitoring was undertaken between September 2020 and April 2021 and a wide range of water depths were recorded. Therefore it is clear that the water depth across the site exhibits a significant seasonal variation.

Water strikes were not recorded during RSK's investigation, however as this was undertaken in August, this would not be unexpected. The installation of the additional groundwater monitoring wells by E&P was undertaken in March 2021 and some water strikes were noted at a depth of around 4 m bgl. This is deeper than the resting perched groundwater table at this time of year, however this is likely to be a result of the cohesive nature of the soils and the low ingress rate of the groundwater. Therefore, any trenches as part of the construction works are likely to remain dry if left open for short periods, but water is likely to seep into these excavations if left open for longer periods, particularly during wetter periods of the year."

4.3.6 With this in mind, the location and depth of proposed SuDS and underground structures (e.g. foundations and drainage infrastructure) must consider the likelihood of perched groundwater in their design and construction.

4.3.7 Since the groundwater is deemed to be a perched water body in the Head Deposits, which are generally cohesive, the associated risk is deemed to be manageable through appropriate design of site levels and finished floor levels.

- 4.3.8 Should the risk of groundwater discharging directly into SuDS be confirmed and the provision of additional runoff storage volume proven unfeasible, measures to divert groundwater flows around SuDS and towards the watercourses – such as impermeable lining and land drains – will be designed and implemented to ensure groundwater flows reach the intended recipients without posing a flood risk to the proposed development.
- 4.3.9 Despite the recommendations made by E&P, it is recommended that provision is made for dewatering of excavations and inflow rates may vary across the site.

4.4 Sequential and Exception Tests

- 4.4.1 The sequential, risk-based approach to the location of development is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim is to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.
- 4.4.2 Application of the sequential approach in the master planning process, in particular application of the *Sequential Test*, helps ensure that development can be safely and sustainably delivered, and developers do not waste resources promoting proposals which are inappropriate on flood risk grounds.
- 4.4.3 The *Sequential Test* ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The aim is to steer new development to Flood Zone 1 (areas with a low probability of sea or river flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of sea or river flooding), applying the *Exception Test* if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of sea or river flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the *Exception Test* if required.
- 4.4.4 Table 2 of the *Flood Risk and Coastal Change Guidance* categorises different types of uses and development according to their vulnerability to flood risk. Table 3 of the *Flood Risk and Coastal Change Guidance* (Table 4.2) maps these vulnerability classes against flood zones to indicate where development is appropriate and where it should not be permitted.

Table 42: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zone	Flood Risk Vulnerability				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test	✓	✓	✓
Zone 3	Exception Test	✗	Exception Test	✓	✓
Zone 4	Exception Test	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted

- 4.4.5 The site is located in Flood Zone 1 and at no significant risk of flooding from any potential source, thus following a sequential approach to steer development away from flood risk. The Exception Test is not required for less vulnerable development in Flood Zone 1.

5 SURFACE WATER DRAINAGE STRATEGY

5.1 Existing Drainage (Greenfield Runoff)

5.1.1 Runoff generated within the existing developed part of the site is understood to be conveyed towards the ditch along the western boundary.

5.1.2 Greenfield runoff rates of 10.3 l/s (100.0% AEP), 12.1 l/s (Q_{BAR}), 27.5 l/s (3.3% AEP) and 38.7 l/s (1.0% AEP) have been established for the development site using the *IH124* methodology with *ICP SuDS* correction for small catchments (Appendix C).

5.2 Hierarchy for Surface Water Disposal

5.2.1 The National Standards for Sustainable Drainage Systems (Defra, 2011) state that the following options must be considered in accordance with the hierarchy for surface water disposal:

Discharge to Ground (Infiltration)

5.2.2 Based on the available geologic and hydrogeological information (Section 3 of this report), infiltration drainage is deemed unfeasible at the development site.

Discharge to Surface Water Body

5.2.3 There are appropriate surface water bodies to the west of the site, into which it is proposed to discharge surface water as detailed further in the following sections.

Discharge to Sewer

5.2.4 As discharge to surface water is proposed, discharge to sewer is not considered further.

5.3 Proposed Drainage Strategy

5.3.1 The proposed surface water drainage strategy has been designed in accordance *Sewers for Adoption* and / or *Building Regulations Part H* and in compliance with the *NPPF*, local requirements and current best practices¹, to collect, convey and attenuate runoff from all impermeable areas (3.65 ha) before discharging into the ditch to the west of the site.

5.3.2 Given the unfeasibility of infiltration drainage, the volume of runoff leaving the proposed development cannot be reduced to greenfield / existing values and the excess volume must be discharge at a low rate that will not pose a flood risk downstream of the site. The proposed drainage strategy has been designed to limit discharge to the Q_{BAR} greenfield runoff rate of 12.1 l/s.

5.3.3 The proposed drainage strategy divides the site into two catchments; the residential development and associated infrastructure, and the public open space (POS) in the south (Appendix D). A drainage strategy is appended which demonstrates how the drainage principles can be met.

¹ e.g. *Non-Statutory Technical Standards for Sustainable Drainage Systems* (March 2015) and *The SuDS Manual* (2015).

- 5.3.4 Surface water run-off from the residential catchment will be collected via a series of rainwater pipes and permeable paving before discharging into a below ground drainage network. This conveys run-off in a similar direction to the current drainage, through pipes to a SuDS basin and attenuation crates in the northwest of the site, and subsequently discharge by means of a new piped outfall to the ditch to the west of the site. The discharge rate is limited to the Qbar rate of 12.1 l/s. The SuDS accommodate run-off from a 1 in 100 year storm event plus 45% increase in rainfall due to climate change plus 300mm freeboard.
- 5.3.5 A ditch is proposed to the south of the residential development / north of POS in the south of the site. This proposed ditch will connect directly to the existing western ditch and is proposed as a compensation ditch due to the removal of an existing ditch that once crossed the site. The ditch is provided for ecological enhancements as requested by Arun LLFA. The ditch does not serve the proposed drainage system serving the site.
- 5.3.6 Initial feedback has been received from Arun (Appendix E) as part of a land drainage consent application which had been applied for under a previous planning application. We have endeavoured to meet the LLFA's requests in latest proposals.
- 5.3.7 The proposed drainage strategy (Appendix D) has been designed so that:
- flooding does not occur on any part of the site for all events up to 3.3% AEP (1 in 30 years);
 - flooding does not occur in any part of a building or utility plant susceptible to water for all events up to 1.0% AEP (1 in 100 years) + 45% climate change allowance.
- 5.3.8 The performance of the proposed surface water drainage strategy has been tested for storm events with 100.0% AEP, 3.3% AEP and 1.0% AEP + 45% climate change and durations of 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640 and 10080 minutes.
- 5.3.9 The results of the simulations are included in Appendix E and demonstrate how the proposed surface water drainage strategy can manage surface water flood risk at the development site without increasing flood risk elsewhere for storm events up to the 1.0% AEP + 45% climate change allowance.
- 5.4 Sustainable Drainage Systems (SuDS)**
- 5.4.1 In accordance with the *NPPF*, (major) developments should incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate. In addition to water quantity control, SuDS should consider opportunities to provide water quality and amenity / biodiversity benefits (i.e. multifunctionality approach).
- 5.4.2 While the proposed drainage strategy is largely reliant on permeable paving in driveways and the roads that will remain private, a detention basin and a swale to manage runoff quantity, Table 5.1 shortlists other SuDS deemed compatible with the site's characteristics and which inclusion in the proposed development must be continuously assessed as the design progresses.
- 5.4.3 It is important to note the need to remove silt from runoff prior to discharge into SUDS features. SuDS such as filter drains, swales, bioretention systems and permeable paving are

sustainable alternatives to proprietary treatment systems otherwise required to manage silt.

Table 5.1: Sustainable Drainage Systems (SuDS)

SuDS Component	Description and Opportunities
Green / Blue Roofs	Green roofs are areas of living vegetation installed on the top of buildings for a range of reasons including visual benefit, ecological value, enhanced building performance and reduction of surface water runoff. A blue roof is a roof designed explicitly to store water for use within the building (rainwater harvesting) or controlled discharge. Green roofs that include reservoir storage zones beneath the growing medium could also be considered blue roofs. Green roofs can improve the thermal performance of buildings, help combat the urban heat island effect and contribute to improved air quality. Through evapotranspiration, green roofs can reduce peak flow rates to a site drainage system (principally for small and medium-sized events) but are unlikely to have a significant impact on downstream attenuation storage requirements. Blue roofs can be designed to provide significant attenuation (and evapotranspiration). Pitched roofs are not conducive to the use of blue / green roofs but their use could be considered for structures where flat roofs are proposed. Due to nature of the scheme, green roofs are not proposed.
Filter Drains/Strips	Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pre-treated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled. Filter drains can be effectively incorporated into the landscape and public open spaces and can have minimal land-take requirements. The use of filter drains is typically restricted to flat sites (unless placed parallel to contours). Filter drains are best located adjacent to (small) impermeable surfaces such as car parks and roads / highways. Due to the proposal for permeable paving to be used for private areas and driveways, filter drains/strips are not proposed.
Swales	Swales are shallow, flat bottomed, vegetated open channels designed to treat, convey and often attenuate surface water runoff. Swales can also provide aesthetic and biodiversity benefits. Swales can help reduce flow rates by facilitating infiltration and / or providing attenuation storage when flow at the outlet is controlled. Coarse to medium sediments and associated pollutants can be removed by filtration through surface vegetation and ground cover. Swales are well suited for managing runoff from linear features such as main roads / highways. Swales are generally difficult to incorporate into dense urban developments, where space is limited. A swale is proposed to the north of the POS in the south of the site.

Subs Component	Description and Opportunities
Bioretention Systems	Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration / evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments / densities using different shapes, materials, planting and dimensions. A bioretention system is not proposed on the development. An adoptable detention basin has been proposed instead.
Permeable Paving	Permeable paving provide a pavement suitable for pedestrian and / or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before use, infiltration to the ground or controlled discharge downstream. Permeable paving help reduce flow rates from a site by providing attenuation storage. A flow control structure is required to constrain the rate of water discharged from the sub-base via an outlet pipe. Pervious pavement drainage has been shown to have decreased concentrations of a range of surface water pollutants, including heavy metals, oil and grease, sediment and some nutrients. Permeable paving are typically built as an alternative to impermeable surfaces and therefore require no extra development space for their construction. Permeable paving is proposed for the private driveways and shared driveways across the site.
Detention Basins	Detention basins are landscaped depressions that are normally dry expect during and immediately following storm events. They can be on-line components where surface runoff from regular events is routed through the basin or off-line components into which runoff is diverted once flows reach a specific threshold. Detention basins can be vegetated depressions (providing treatment in on-line components) or hard landscaped storage areas. Off-line basins will normally have an alternative principal use (e.g. amenity or recreational facility or urban (hard) landscaping). A large adoptable detention basin is proposed in the north western corner of the site. The basin will also provide planting and habitat as per ecologist recommendations and ICOSA requirements.

SuDS Component	Description and Opportunities
Attenuation Tank	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before use, infiltration or controlled release. Attenuation storage tanks can help reduce flow rates from a site by providing significant attenuation storage. Storage tanks do not provide any form of treatment of surface water runoff and therefore need to be combined in a “management train” with other methods that do provide suitable treatment of all relevant pollutants (coarse sediment must always be removed upstream of a storage tank). The inherent flexibility in size and shape of the typical attenuation storage tank systems means that they can be tailored to suit the specific characteristics and requirements of any site. However, the lack of amenity and biodiversity benefits means that storage tanks should be a last resource in any surface water drainage strategy for a major development. In this case the provision of the attenuation tank allows the surface to be used as POS and LEAP area. A 28m x 16m x 1.6m deep cellular attenuation tank is proposed beneath the POS / LEAP in the north west of the site.

5.5 Exceedance Events

5.5.1 Plot levels are set 150 mm above external ground levels and external ground levels have been designed to safely route overland flows away from buildings and towards the watercourse to the west of the site, using the less vulnerable parts of the proposed development such as public open spaces, parking areas and roads to convey and store overland flows.

5.5.2 Overland flows resulting from exceedance events are expected to leave the developed site to the west as currently occurs (i.e. pre-development conditions), without posing any increased flood risk on site or elsewhere.

5.6 Water Quality Management

5.6.1 The suitability of the proposed drainage strategy to manage the development’s pollution risk has been assessed using the simple index approach in *The SuDS Manual* (2015), as summarized in .

Table 5.1: Surface Water Quality Management (Simple Index Approach)

Runoff Route / Treatment Train 1 – Residential Area				
Land Use / SuDS	Hazard Level	TSS	Metals	Hydrocarbons
Pollution Hazard Indices				
Residential Roofs	Very Low	0.20	0.20	0.05
Driveways, residential car parks and low traffic roads	Low	0.50	0.40	0.40
SuDS Mitigation Indices				
Permeable paving	-	0.70	0.60	0.70
Detention Basin	-	0.50	0.50	0.60
Total SuDS Mitigation Index = Permeable paving Index + 0.5 (Detention Basin Index)				

Detention Basin	-	0.95	0.85	1.0
Total SuDS Mitigation Index ≥ Pollution Hazard Index (for each contaminant type)				

Runoff Route / Treatment Train 2 – POS in the south of the site				
Land Use / SuDS	Hazard Level	TSS	Metals	Hydrocarbons
Pollution Hazard Indices				
POS in the south of the site (analogous to driveways, residential car parks and low traffic roads)	Low	0.50	0.40	0.40
SuDS Mitigation Indices				
Swale	-	0.50	0.60	0.60
Total SuDS Mitigation Index ≥ Pollution Hazard Index (for each contaminant type)				

5.7 Operation and Maintenance

- 5.7.1 The function of the surface water drainage system must be understood by those responsible for maintenance, regardless of whether individual components are below ground or on the surface. In any system properly designed, monitored and maintained, performance deterioration can usually be minimised.
- 5.7.2 The long-term operation and maintenance of the proposed surface water drainage strategy will be the responsibility of the entities as detailed in Table 5.2. Appropriate legal agreements defining maintenance responsibilities and access rights over the lifetime of the proposed development must be established prior to construction.

Table 5.2: Entities Responsible for SuDS Maintenance

SuDS Component	Location	Function	Responsible Entity
Swale	POS in the south of the site	Store, convey and treat runoff	Private management company
Permeable paving	Private & public parking areas	Store & treat runoff	Owner or private management company
Attenuation Tanks	POS/LEAP North West of site	Store Runoff	Water Authority - ICOSA
Detention Basin	North west of site	Store & treat runoff	Water Authority - ICOSA

- 5.7.3 Where the user / benefiter of a system is not responsible for maintenance, then it is important to ensure that they know when the SuDS is not functioning correctly and who to contact if any issue arises.
- 5.7.4 Maintenance plans are often required to clearly identify who is responsible for maintaining proposed SuDS as well as the maintenance regime to be applied. Maintenance plans can also form a useful tool for public engagement with SuDS and understanding their wider

benefits. The maintenance requirements of the proposed surface water drainage strategy are summarised in .

Table 5.2: Typical Operation and Maintenance Requirements

Operation and Maintenance Activity			
	Swale	Permeable paving	Detention Basin
Regular Maintenance			
Inspection	■	■	■
Litter and debris removal	■	■	■
Grass cutting	■	□	■
Weed and invasive plant control		□	□
Shrub management (including pruning)	□	□	□
Shoreline vegetation management			□
Aquatic vegetation management			□
Occasional Maintenance			
Sediment management	■	■	■
Vegetation replacement	□		□
Vacuum sweeping and brushing		■	
Remedial Maintenance			
Structure rehabilitation/repair	□	□	□
Infiltration surface reconditioning	□	□	

■ Will be required

□ May be required

5.8 Drainage During Construction

5.8.1 Drainage is typically an early activity in the construction of a development, taking form during the earthworks phase. However, the connection of piped drainage system to SuDS components should not take place until the end of construction works, unless a robust strategy for silt removal prior to occupation of the site is implemented.

5.8.2 Silt-laden runoff from construction sites represents a common form of waterborne pollution and cannot enter SuDS components not specifically designed to manage this, as it can overwhelm the system and pollute receiving water features. Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to SuDS components.

5.8.3 The three principal aspects of drainage during construction are conveying runoff, controlling runoff and trapping sediments:

- Conveyance of runoff can be achieved through small ditches / swales, channels and drains. Runoff control measures should be implemented to ensure that runoff does not overwhelm the temporary drainage system causing flooding on site or elsewhere.

- Control of runoff can be achieved through perimeter ditches or appropriate grading to ensure that any runoff from the construction site stays on site. Runoff rates leaving the site should be managed so they do not exceed pre-development conditions.
- Construction runoff should be directed to dedicated infiltration basins with adequate upstream sediment and pollution control such as sediment basins, silt fences and straw bales prior to infiltration or off-site discharge.

5.8.4 Additional conveyance, control and treatment measures should be installed as needed during grading. Slope stability needs to be considered when using open water features to convey, control and treat runoff across the site. Any necessary surface stabilisation measures should be applied immediately on all disturbed areas where construction work is either delayed or incomplete.

5.8.5 Maintenance inspections should be performed weekly, and maintenance repairs should be made immediately after periods of rainfall.

5.8.6 All drainage infrastructure (namely underground features) must be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers and storing construction materials away from the drainage infrastructure.

5.9 Compensation Ditch

5.9.1 A compensation ditch is proposed to the south of the residential development / north of POS in the south of the site. The ditch is provided for ecological enhancements as requested by Arun LLFA and is proposed as a compensation ditch due to the removal of an existing ditch that historically crossed the site.

5.9.2 Redrow are accommodating the LLFA's request by providing the ditch within the extent of the application site that is within Redrow's control. However, it should be noted that the ditch does not form part of the developments drainage, since this is accommodated by the system described in section 5.3 which alone meets the requirements of the NPPF. As such the ditch does not form part of any drainage mitigation.

5.9.3 This proposed ditch will connect directly to the existing western ditch (either as an open cut connection or a short piped connection), and located within the ecological buffer of the development. The ditch is proposed to have 1in1 sides and be 1m deep.

5.9.4 Initial feedback has been received from the LLFA with regards to the compensation ditch in e-mail dated 03.05.22, which we have sought to accommodate in the latest proposals. A copy of the correspondence is provided in Appendix E.

7 CONCLUSIONS AND RECOMMENDATIONS

- 7.1.1 JNP Group has been commissioned by Redrow Homes to prepare a Flood Risk Assessment for the proposed residential development to the west of Arundel Road in Angmering, West Sussex.
- 7.1.2 The site comprises agricultural land and an existing small industrial park and caravan storage facility.
- 7.1.3 The site slopes from c. 23m aOD in the east to 11m aOD in the west.
- 7.1.4 The site is underlain by Head deposits underlain by the London Clay Formation.
- 7.1.5 The underlying strata are classified as a Secondary (Undifferentiated) Aquifer (Head deposits). The London Clay is not classified as an aquifer. The site is not in a groundwater source protection zone.
- 7.1.6 Based on the available geologic and hydrogeologic information, and the previous use of the site, infiltration drainage is deemed unfeasible at the development site.
- 7.1.7 An unnamed watercourse is located c. 70m to the north of the site, flowing north east to west. A ditch is located along the western site boundary. The northern part of this falls towards the unnamed watercourse. The part of the ditch near the south western corner of the site is understood to connect to a ditch to the west via a culvert, with this ultimately
- 7.1.8 The Flood Risk Assessment section of this report demonstrates that the risk of flooding from all sources (fluvial, tidal, surface water, groundwater, sewer and reservoir) is low.
- 7.1.9 Surface water run-off from the residential catchment will be collected via a series of rainwater pipes and permeable paving before discharging into a below ground drainage network. This conveys run-off in a similar direction to the current drainage, through pipes to a SuDS basin and attenuation crates in the northwest of the site, and subsequently discharge by means of a new piped outfall to the ditch to the west of the site. The discharge rate is limited to the Qbar rate of 12.1 l/s. The SuDS accommodate run-off from a 1 in 100 year storm event plus 45% increase in rainfall due to climate change plus 300mm freeboard.
- 7.1.10 The proposed drainage strategy has been designed so that:
- flooding does not occur on any part of the site for all events up to 3.3% AEP (1 in 30 years);
 - flooding does not occur in any part of a building or utility plant susceptible to water for all events up to 1.0% AEP (1 in 100 years) + 45% climate change allowance.
- 7.1.11 Foul water for the development is proposed to be conveyed via a part gravity (where possible) and pumped system into the new Southern Water foul sewer network (EX F19 MH) along Arundel Road. The proposed discharge point is a newly constructed S.104 foul sewer serving the adjacent development which has now been completed.
- 7.1.12 In conclusion, the proposed development is not at risk of flooding and does not increase flood risk off-site.
- 7.1.13 This report is intended for the use of the developer of the site in support of their planning application for the site only.

8 LIMITATIONS

- 8.1.1 The information, conclusions and recommendations presented within this report are deemed to be current at the time of issue. No guarantee can be given to the status of this information other than at the time of issuing. Where necessary, the user shall confirm the status of any applicable assessments and consents.
- 8.1.2 This report has been commissioned by Redrow Homes. No third party may receive a copy of this report without first obtaining our permission in writing.
- 8.1.3 This report is confidential and has been prepared solely for the benefit of Redrow Homes and those parties with whom a warranty agreement has been executed or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of this report, written approval must be sought from JNP Group and a charge may be levied against such approval. JNP Group accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, or this document being used by any third party with whom an agreement has not been executed.
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ARUN DISTRICT COUNCIL A/48/22/RES



THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

LOCAL SCALE FACTOR: 0.9987400

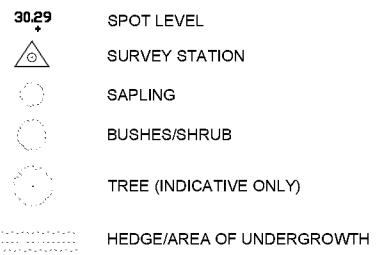
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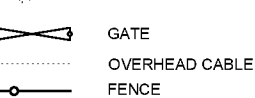
NO ALLOWANCE HAS BEEN MADE FOR SUB SURFACE ACCESS TO MANHOLES OR CHAMBERS. ANY PIPE SIZES, DEPTHS OR BELOW GROUND DIMENSIONS ARE TAKEN FROM THE SURFACE AND THUS WILL ONLY BE APPROXIMATE. ANY FLOW TYPE (FOLI, WATER, SURFACE WATER OR COMBINED) ARE ASSUMED AND THEREFORE REQUIRE VERIFICATION.

ROAD MARKINGS:-

LEGEND



CONTOUR



ABBREVIATIONS

[illegible]

STATION CO-ORDINATES

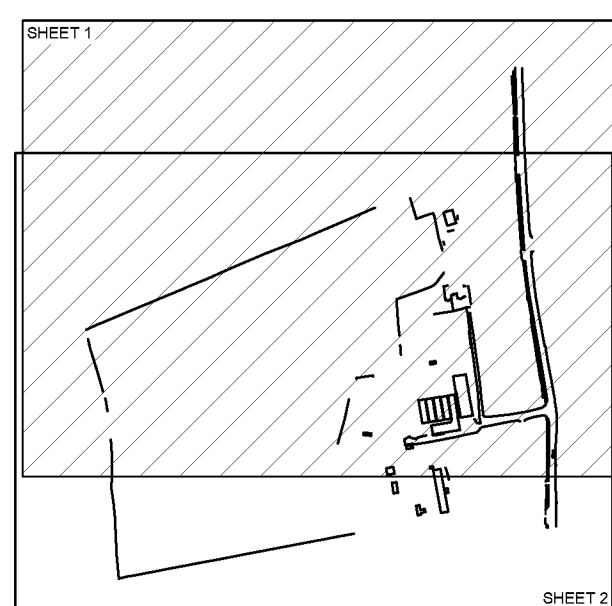
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STN3	509746.03	102555.24	20.37	Survey Nail
STN4	509732.58	102643.52	22.85	Survey Nail
STN6	509728.18	102655.13	17.13	Survey Nail
STN50	509888.45	102624.28	17.92	Survey Nail
STN51	509867.78	102629.31	18.16	Survey Nail
STN56	509825.22	102627.80	16.42	Survey Nail

TREE SCHEDULE

No.	DIAM.	SPREAD σ	HEIGHT
TE1	0.50	10	8
TE2	1.00	8	20
TE3	0.60	8	20
TE4	0.80	12	12
TE5	0.70	8	20
TE6	0.90	8	20
TE7	0.90	8	20
TE8	1.40	20	20
TE9	0.60	12	12
TE10	0.60	12	10
TE11	0.15	8	8
TE12	0.80	12	12
TE13	0.30	6	6
TE14	0.30	6	6
TE15	0.00	10	10
TE16	0.30	6	8
TE17	0.30	6	8
TE18	0.40	2	3
TE19	0.80	8	8

REE DIAMETER MEASURED APPROXIMATELY 1.5M ABOVE GROUND LEVEL. TREE
SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALED
CANOPY SIZE. TREE BOLE MAY NOT SIT CENTRALLY TO THE CANOPY. TREE HEIGHT
ESTIMATED FROM GROUND LEVEL.

PLOT LOCATIONS



Rev	Date	Revision notes	B
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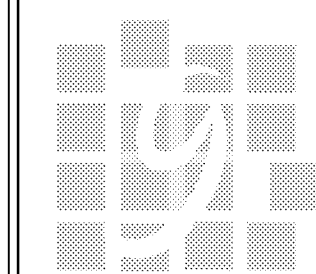
Status

INFORMATION

Project

**Arundel Road,
Angmering.**

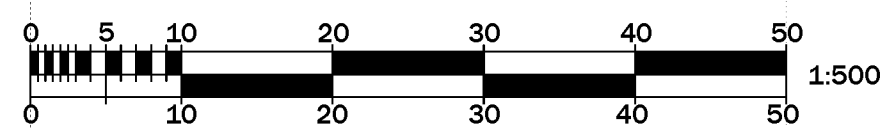
Title	TOPOGRAPHICAL SURVEY AS OF 13.09.17 SHEET 1 OF 2
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GLADMAN
Gladman House, Alexandria Way
Compton Business Park
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Tel: 01260 288800
Fax: 01260 288899
www.gladman.co.uk

Drawn By	Publish Date	Scale(s)	Sheet Size
		1-500	A0

Project no.	Drawing no.	Revision
2017-084	Topo_01_2D	0





THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

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SITE CENTRE: E 505527.7405, N 105538.600

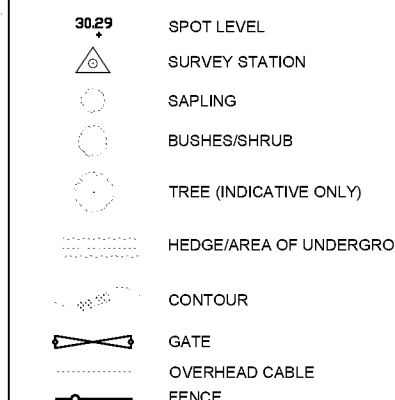
ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE OF NETWORK.

DRAINAGE

NO ALLOWANCE HAS BEEN MADE FOR SUB SURFACE ACCESS TO MANHOLES OR CHAMBERS. ANY PIPE SIZES, DEPTHS OR BELOW GROUND DIMENSIONS ARE TAKEN FROM THE SURFACE AND THIS WILL ONLY BE APPROXIMATE. ANY FLOW TYPE (FOUL WATER, SURFACE WATER OR COMBINED) ARE ASSUMED AND THEREFORE REQUIRE VERIFICATION.

ROAD MARKINGS DISPLAYED ARE SYMBOLIC. LENGTH, SPACING AND THICKNESS ETC. ARE INDICATIVE ONLY.

LEGEND



ABBREVIATIONS

[illegible]

STATION CO-ORDINATES

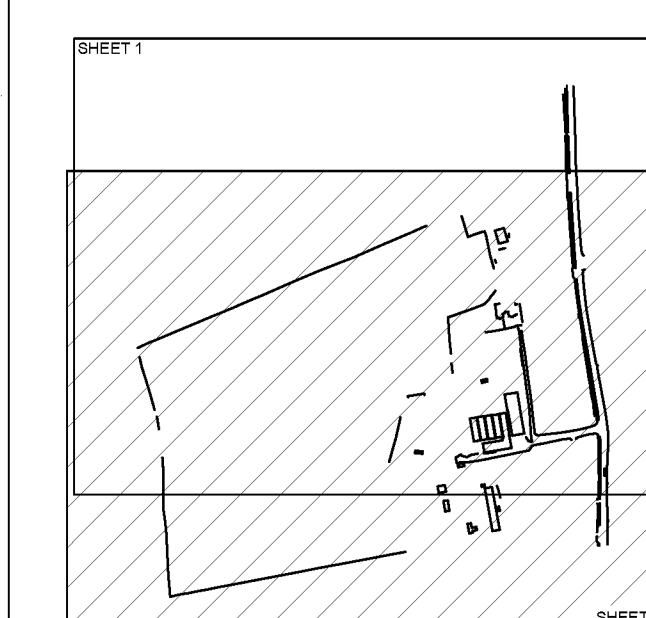
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STN/3	508746.03	105355.24	20.37	Survey Nail
STN/4	508732.58	105443.92	22.85	Survey Nail
STN/6	508736.18	105565.15	17.13	Survey Nail
STN/50	50888.45	105284.28	17.92	Survey Nail
STN/51	508907.78	105289.31	18.16	Survey Nail
STN/56	508925.22	105271.80	16.42	Survey Nail

TREE SCHEDULE

No	DMM	SRRSD σ	HEKHT
TE1	0.50	10	5
TE2	1.00	8	20
TE3	0.60	8	20
TE4	0.00	12	12
TE5	0.70	8	20
TE6	0.90	8	20
TE7	0.90	8	20
TE8	1.40	20	20
TE9	0.50	12	12
TE10	0.60	12	10
TE11	0.15	8	8
TE12	0.80	12	12
TE13	0.30	6	6
TE14	0.30	6	6
TE15	0.90	10	10
TE16	0.30	6	6
TE17	0.60	6	8
TE18	0.40	2	3
TE19	0.80	5	5

TREE DIAMETER MEASURED APPROXIMATELY 1.5M ABOVE GROUND LEVEL. TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE. TREE BOLE MAY NOT SIT CENTRALLY TO THE CANOPY. TREE HEIGHT ESTIMATED FROM GROUND LEVEL.

PLOT LOCATIONS



Rev	Date	Revision notes	B
DO NOT SCALE			

Status	
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INFORMATION

Project

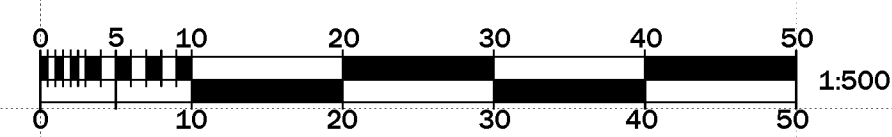
Arundel Road
Angmering.

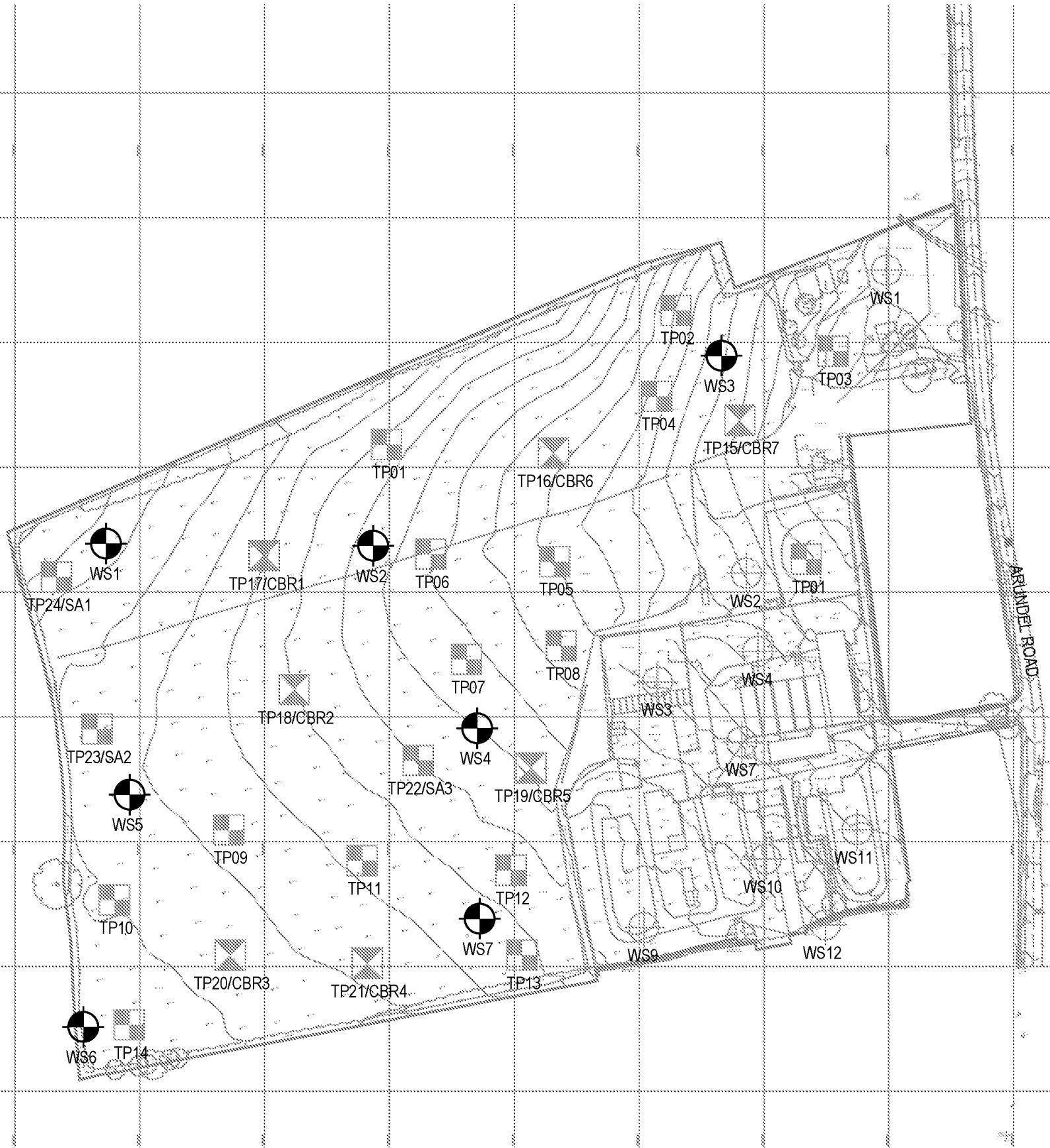
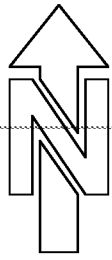
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TOPOGRAPHICAL SURVEY
AS OF 13.09.17
SHEET 2 OF 2



Drawn By	Publish Date	Scale(s)	Sheet Size
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Project no.	Drawing no.	Revision	
2017-084	Topo_02_2D	0	





INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE.
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

- Approximate location of trial pit excavated by RSK in August 2020
- Approximate location of trial pit with CBR excavated by RSK in August 2020
- Approximate location of window sample borehole carried out by RSK in August 2020
- Approximate location of window sample borehole carried out by Eastwood & Partners on 04.03.2021

A	First Issue.			
REV	DESCRIPTION	SIG	CHK	DATE

REDROW HOMES LTD

LAND OFF ARUNDEL ROAD,
ANGMERING

EXPLORATORY HOLE LOCATION PLAN

Eastwood & Partners

CONSULTING ENGINEERS

St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Tel 0114 255 4554
Fax 0114 255 4330

mail@eastwoodandpartners.com
www.eastwoodandpartners.com

SCALE WHEN PLOTTED AT A3 1:2000			DRAWING STATUS PRELIMINARY	
DRAWN TC	CHECKED CC	DATE 22.03.2021	DRAWING NUMBER 45487/002	REV A

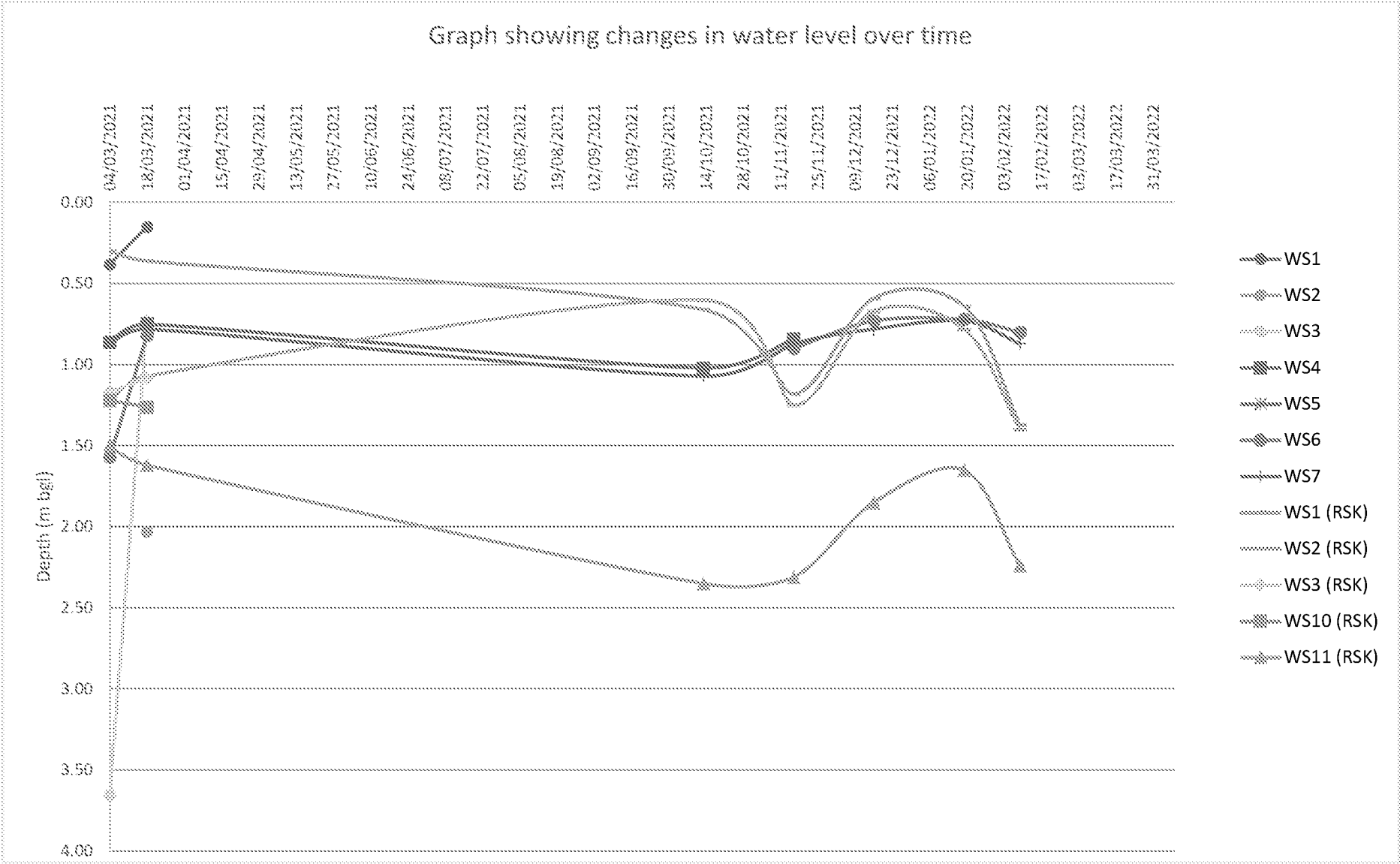
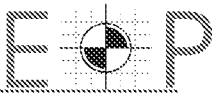
Winter Groundwater Monitoring Results

BH	Monitoring Date							Depth
	04/03/2021	18/03/2021	13/10/2021	16/11/2021	16/12/2021	19/01/2022	09/02/2022	
WS1	0.38	0.15						2.40
WS2		2.03						4.00
WS3	3.65	0.73						4.00
WS4	0.86	0.75	1.02	0.84	0.71	0.65	0.71	3.12
WS5		0.93	1.73	0.77	0.53	0.64	0.78	4.00
WS6	1.57	0.82		0.90	0.73	0.72	0.80	3.00
WS7	0.87	0.78	1.07	0.87	0.78	0.73	0.87	3.92
WS1 (RSK)	0.30	0.36	0.66	1.18	0.59	0.64	1.37	2.80
WS2 (RSK)	1.24	1.07	0.60	1.25	0.67	0.78	1.40	4.00
WS3 (RSK)	1.17	1.08						3.05
WS4 (RSK)								
WS7 (RSK)								
WS9 (RSK)								
WS10 (RSK)	1.22	1.26						2.70
WS11 (RSK)	1.50	1.62	2.35	2.31	1.85	1.65	2.24	4.18

Well monitored and found to be dry

Could not locate

Well located but found to be damaged. Monitoring not possible.

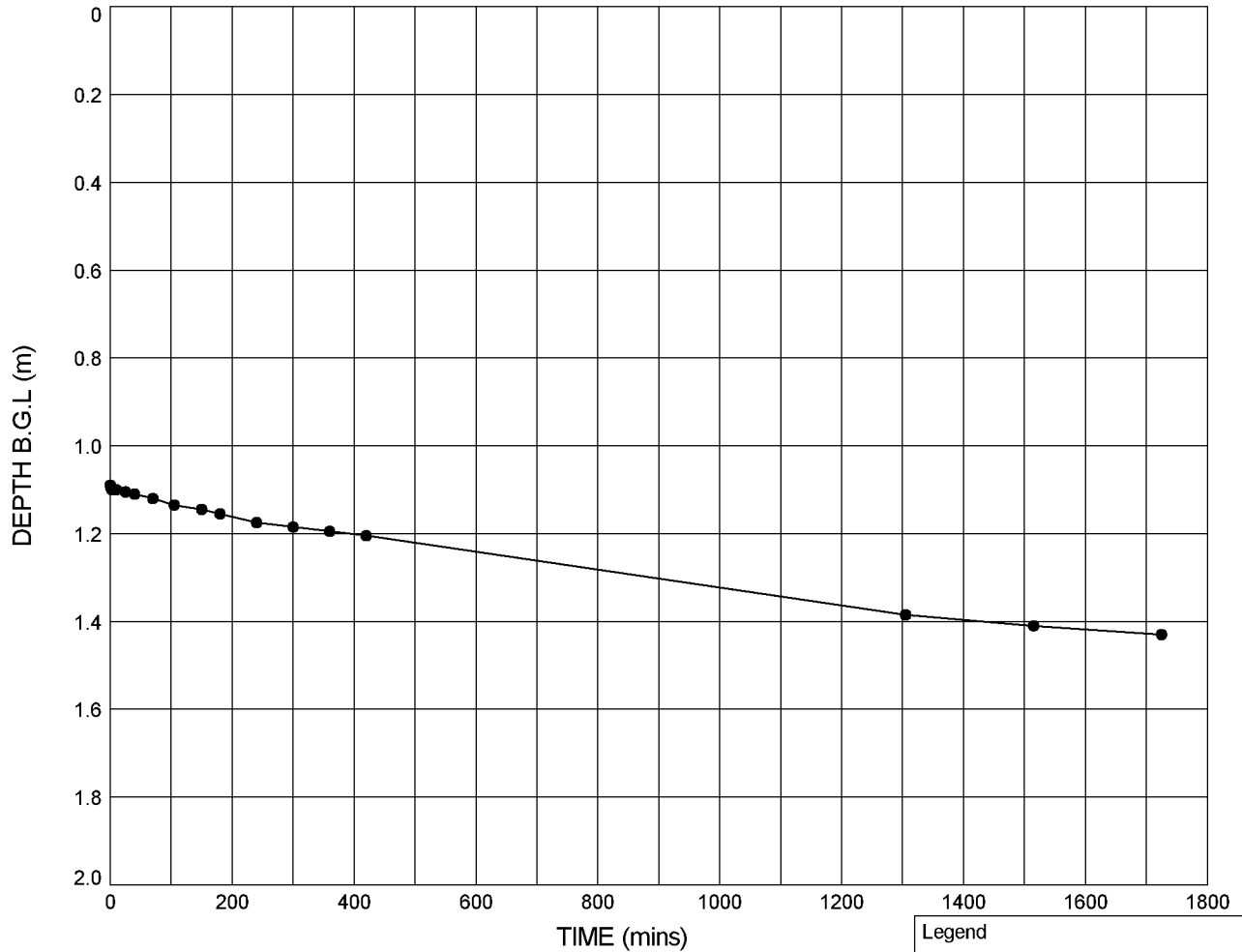


FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **TPSA1**

Plot of Depth of Water Below Ground Level Against Time



Test 1

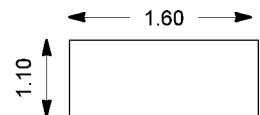
Pit start depth: = **2.00** m
 Pit final depth: = **1.95** m
 Effective depth, D_e = **0.86** m
 Effective storage volume, V_{p75-25} = **0.7568** m³
 Surface area, a_{p50} = **4.0820** m²
 Time, t_{p75-25} = **240950** secs
 Infiltration rate, f = **7.69×10^{-7}** m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (26.08.20)

Plan (Not to scale)



No Bearing Taken



STRUCTURAL SOILS
 1a Princess Street
 Bedminster
 Bristol
 BS3 4AG

Compiled By

K. Flincher

Date

28/08/20

Checked By

[Signature]

Date

01/09/20

Contract

Angmering

Contract Ref:

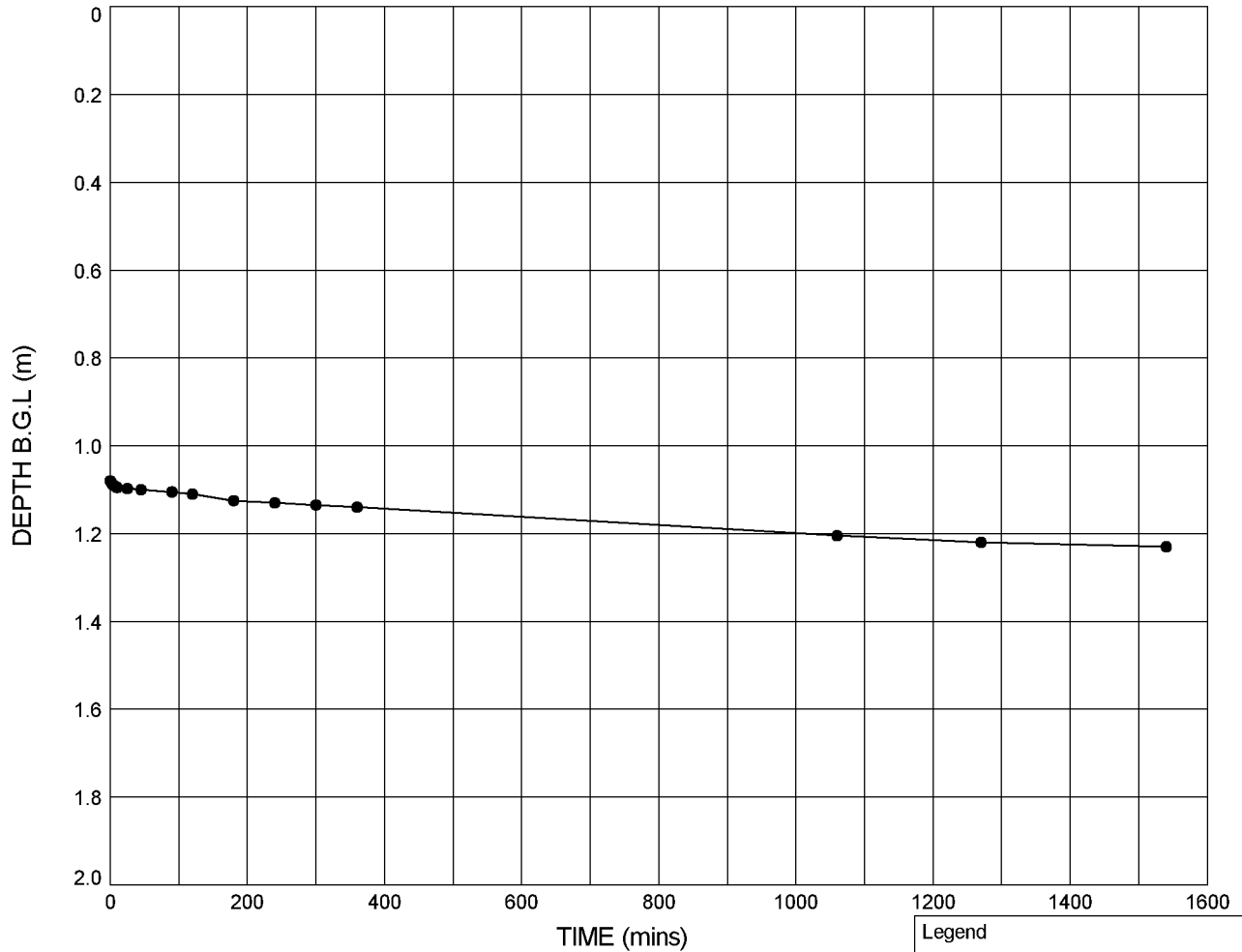
749615

FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **TPSA2**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

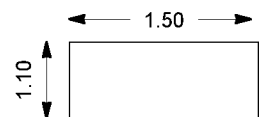
Pit start depth: = **2.00** m
 Pit final depth: = **1.85** m
 Effective depth, D_e = **0.77** m
 Effective storage volume, V_{p75-25} = **0.6353** m³
 Surface area, a_{p50} = **3.6520** m²
 Time, t_{p75-25} = **N/A** secs
 Infiltration rate, f = **N/A** m/s

Notes: Test 1 - Unable to calculate infiltration rate due to insufficient drop in water level.

Legend

● Test 1 (26.08.20)

Plan (Not to scale)



No Bearing Taken



STRUCTURAL SOILS
 1a Princess Street
 Bedminster
 Bristol
 BS3 4AG

Compiled By

Date

Checked By

Date

K. Flunocher

28/08/20

[Signature]

01/09/20

Contract

Contract Ref:

Angmering

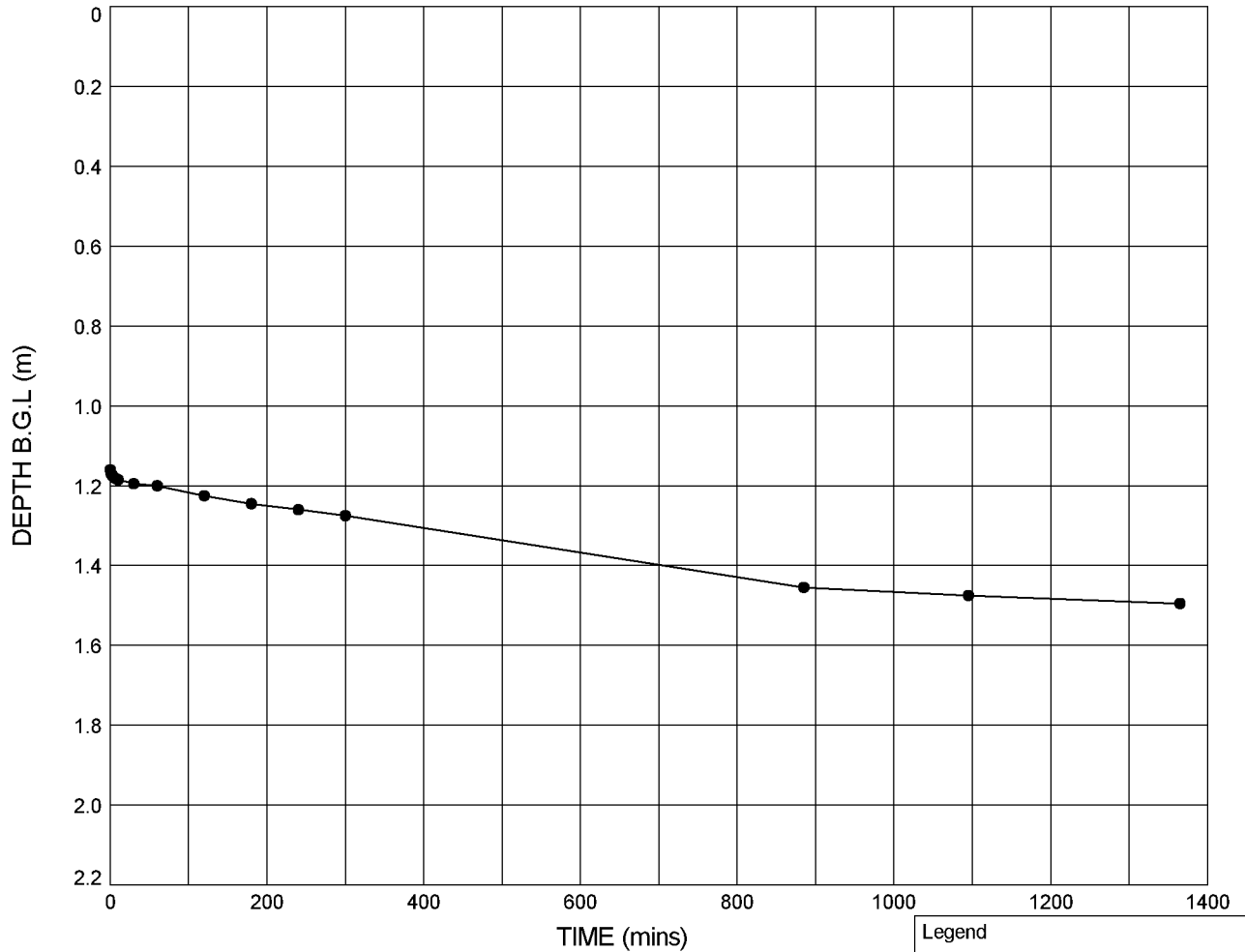
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FULL SCALE SOAKAWAY TEST

Non-standard test

Soakaway Test - Position ID : **TPSA3**

PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

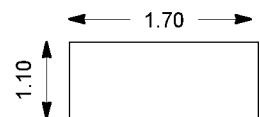
Pit start depth: = **2.10** m
 Pit final depth: = **2.00** m
 Effective depth, D_e = **0.84** m
 Effective storage volume, V_{p75-25} = **0.7854** m³
 Surface area, a_{p50} = **4.2220** m²
 Time, t_{p75-25} = **284325** secs
 Infiltration rate, f = **6.54×10^{-7}** m/s

Please note test data was extrapolated to obtain $t_{p75-tp25}$.

Legend

● Test 1 (26.08.20)

Plan (Not to scale)



No Bearing Taken



STRUCTURAL SOILS
 1a Princess Street
 Bedminster
 Bristol
 BS3 4AG

Compiled By

K. Flincher

Date

28/08/20

Checked By

[Signature]

Date

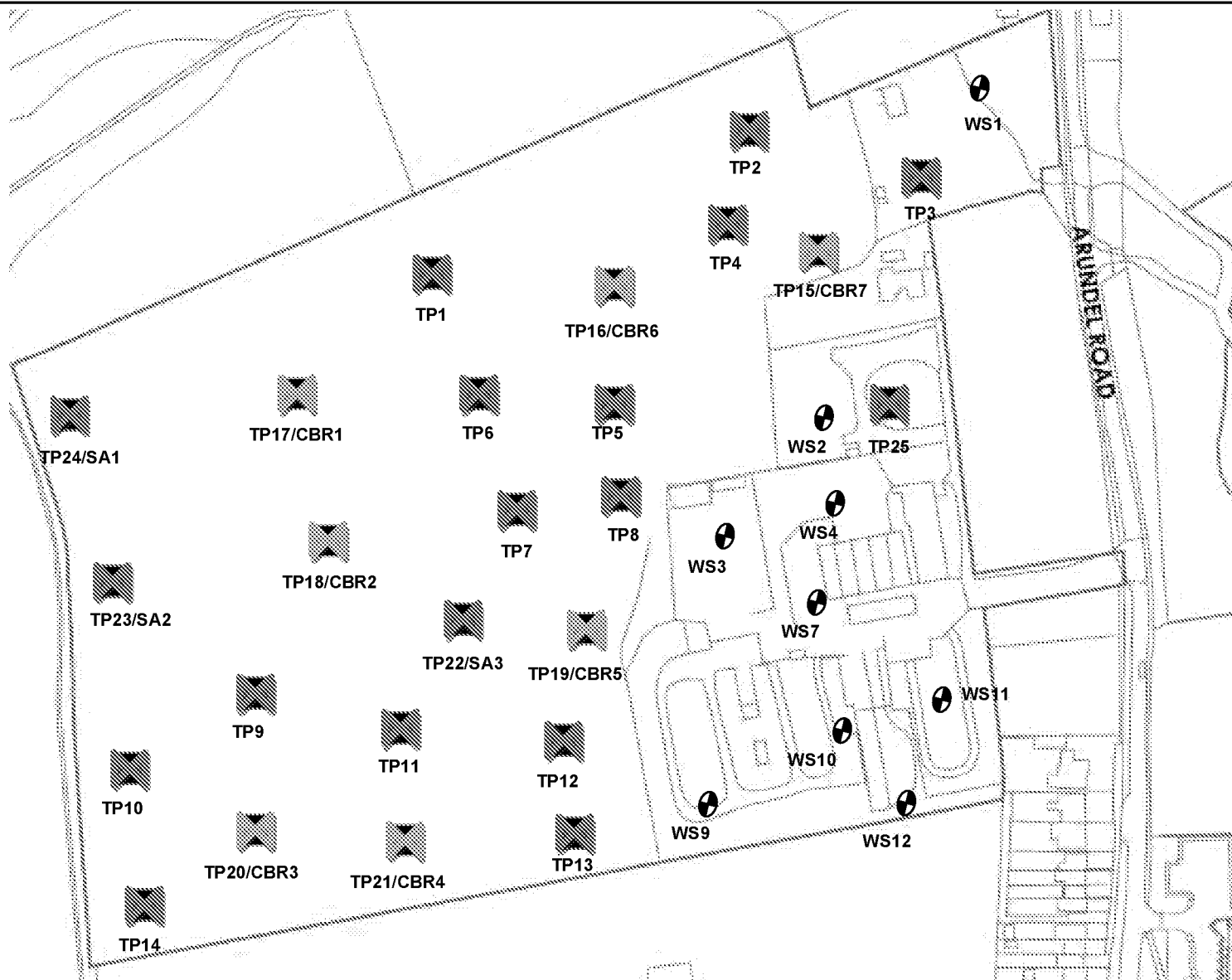
01/09/20

Contract

Angmering

Contract Ref:

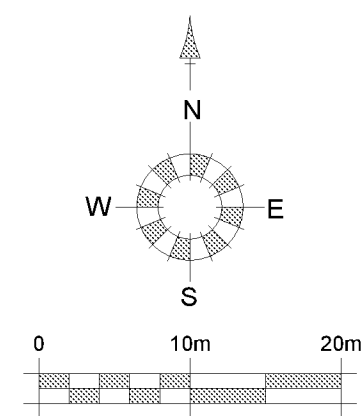
749615



	HOLE LOCATION PLAN	Client: Gladman Developments Ltd	Figure No: Figure 2
		Site: Arundel Rd, Angmering	Job No: 52207
		Scale: NTS	Source:

Pond

Wilmington



Collects

Camp Site

Po

17.1m

Sports Pitch Land (2.1 Hectares)

Please refer to separate technical details
for ecology and landscape proposals
within the 2.1Ha of sports pitch land.

Sports Court

William
Older
Hall

Nursery

Path (um)

Planning

CLIENT: Redrow Homes Ltd.		PROJECT: Arundel Road Angmering	
SCALE: 1:500 (A0 ORIGINAL)		DRAWING: Proposed Site Layout - Redesign 2022	
DRAWN: RDP / RDB DATE: June 2022	20232	P201	L



Broadmede House, Farnham Business Park,
Weydon Lane, Farnham, Surrey GU9 8QT.
info@osparchitecture.com www.osparchitecture.com
Tel: 01252 267878

09 Licence No. 1605821

JNP Group		Page 1
The Innovation Centre Queens Meadow Bus. Park Hartlepool TS25 5TG		
Date 20/08/2021 12:31 PM File	Designed by Muddasser.Ali Checked by	
Micro Drainage		Source Control 2020.1.3

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	3.292	Urban	0.000
SAAR (mm)	749	Region Number	Region 7

Results l/s

QBAR Rural	12.1
QBAR Urban	12.1
Q1 year	10.3
Q1 year	10.3
Q30 years	27.5
Q100 years	38.7

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ARUN DISTRICT COUNCIL A/48/22/RES

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Health & Safety Note

The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

HAZARD IDENTIFICATION BOX			
This table is provided to assist the Principal Contractor to fulfil their obligations under the CDM Regulations 2015			
Hazard	Hazard Type	Hazard Description	Mitigation Measures / Residual Risk
Construction	Construction	Pitched Groundwater	Excavations not to be left open for extended periods. Thorough support required. Hazardous fluids contained. Land drains or other measures may be needed to manage potential groundwater

IMPORTANT

The scheme is subject to the following Statutory Approvals:

- Section 38
- Section 104
- Building Regulations

All construction works prior to approvals above will be undertaken at the contractors risk.

All adoptable drainage works to be installed in accordance with:

- S104 Sewers - Sewers for Adoption including and applicable local Water Authority addendums

Drainage & Road Layout Standard Drawing Notes

- The contractor is to check and verify all buildings and site dimensions and levels, including sewer invert levels, before works start on site.
- The contractor is to comply in all aspects with the current building legislation, British Standards, building regulations etc.
- The contractor is to check the levels of existing sewers which are to be used as an out-fall prior to commencement of any onsite drainage works. Any discrepancies are to be reported to the Engineer.
- This drawing is to be read in conjunction with and checked against all other drawings, Engineering Details, specification and any structural, geotechnical or other specialist document provided.
- Any anomaly or contradiction between any of the above or difference between actual and drawn details is to be reported to Taylor Wimpey South Midlands.
- Drainage works to be adopted under Section 104 of the Water Industries Act 1991 shall comply with DCG published by Water UK and the combined addendum.
- Roads, footpaths and parking areas which form part of the highway to be adopted under Section 38 of the Highways Act 1980 shall comply with the West Sussex Highway Specification.
- All subgrade structures and unconsolidated material within the road construction width to be removed.
- Formation preparation to be in accordance with Highways Agency Specification for Highway Works (SHW) cl. 616. No prepared formation to be continuously exposed to rain causing degradation below design CBR or to be left uncovered overnight.
- Any soft, damaged or weak spots including peat contaminated material are to be excavated and replaced with SHW Type 1 in accordance with SHW cl. 803 laid and compacted to cl. 802, Table 8/4.
- Where ground conditions are deemed to be first susceptible, refer to Ground Investigation report, track thickness shall be 400mm minimum thickness. All material within 450mm of road construction to be non-frost susceptible.
- Positions of existing services/statutory undertaker's apparatus adjacent to or crossing proposed sewers are to be checked by the contractor prior to starting work.

Contractor shall refer to the services information available from the Developer to identify all existing services. It is the Contractor's responsibility to liaise with all relevant services companies to ensure that all existing services are accurately located prior to commencement of works, and adequately protected during construction.

It is the Contractor's responsibility to liaise with the Developer and all relevant services companies to ensure that all new and diverted services are accurately located and adequately protected during construction.

Legend

- Red Line Boundary
- Plot Finished Floor Level (FFL)
- Proposed Road Contour Levels (0.1m intervals)

Foul Drainage Legend

(Dimensions are approx, internal sizes)

- New Adoptable Foul Water Sewer to be constructed in accordance with SSG Appendix C DCG
- New Adoptable Foul Water Manhole (size and construction may vary), to be constructed in accordance with SSG Appendix C DCG
- New Adoptable Foul Rising Main constructed in accordance with SSG Appendix C DCG

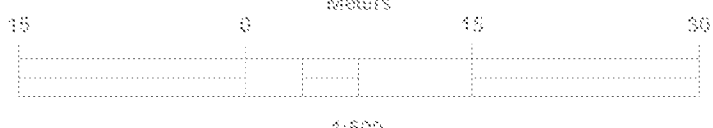
Surface Water Drainage Legend

(Dimensions are approx, internal sizes)

- New Adoptable Surface Water Sewer to be constructed in accordance with SSG Appendix C DCG
- New Adoptable Surface Water Manhole (size and construction may vary), to be built in accordance with SSG Appendix C DCG
- New Deep Trapped Road Gully and connection to be adopted by Highways Authority
- Public Sewer Easement, dimensioned as shown on layout
- Lined Permeable Paving - Only Shared areas illustrated. All Private Drives to be permeable paved too

Flood Routing Legend

- Indicative Overland Route of Excessed Flood Flows
- Surface Water Network Hydraulic Model Overflow Point and Flooded Volume for 1:100yr + 45% Climate Change Storm Event. No Flood Events occur up to this return period on the site



Lined Permeable Paving to all private drives

Proposed 150mm Timber Knee Rail around the perimeter Hard Service Margin.
Top of Bank 13.400

Flow Control
CL 13.350m
Flow Rate = 12.11/s (Qbar)
L 10.54m

Sediment Forebay
Low Flow Channel

Detention Basin
Bank Level = 13.400m
Bed Level = 10.800m
Low Flow Channel 10.386m
Max Water Level 100 +45% 13.005

Rising main (design by others) to route through site and connect to gravity sewer to the east on Arundel Road.

Cellular Attenuation Tank 672m³
28x16x1.6m
L 10.542
To T1 12.542
CL 13.500

Compensation Ditch 1m1 side slope, 1m deep, 0.5m base

Additional Attenuation in 1350D oversize pipe to be adopted by ICOSA

Sports Pitch Land (2.1 Hectares)

400m³ Storage needed based on 100% impermeable commercial area and 1.5/s discharge rate into SSG

Rev	Description	By	Date
P04	15/05/2022	Updated Drain Layout updated to P03L	RED / J.
P03	16/06/2022	Updated Drain Location	RED / J.
P02	01/06/2022	Updated to final layout P02.2	RED / J.
P01	09/05/2022	Issued for information	RED / J.

S2 - Suitable for Information



Client	Redrow
Job	Arundel Road Angmering
File	Drainage Strategy For Planning Only
Drawings	PL 80_20
Scale	1:500
Project	C86473 - JNP - 92-XX- DR - C - 7200 P04

JNP Group		Page 1
The Innovation Centre Queens Meadow Business Park Hartlepool, TS25 5TG	Rev C Drainage Strategy Check Angmering	
Date 29/07/2022 File Drainage Calcs Split Network.MDX	Designed by BID Checked by CC	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm with Commercial Area included

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 506538 105326 TQ 06538 05326
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm with Commercial Area included

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	14.953	0.211	71.0	0.033	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	20.793	1.309	15.9	0.097	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	52.148	1.799	29.0	0.048	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	12.484	0.042	297.2	0.024	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.004	28.609	0.095	301.1	0.148	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.005	19.547	0.065	300.7	0.056	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.006	48.322	0.161	300.0	0.103	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.007	16.090	0.283	56.9	0.056	0.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	27.062	0.463	58.4	0.044	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	54.953	0.590	93.1	0.097	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.21	28.198	0.033	0.0	0.0	0.0	1.19	21.1	4.5
S1.001	50.00	5.30	19.739	0.130	0.0	0.0	0.0	3.86	280.2	17.6
S1.002	50.00	5.59	18.430	0.178	0.0	0.0	0.0	2.93	207.2	24.1
S1.003	50.00	5.74	16.331	0.202	0.0	0.0	0.0	1.41	397.9	27.4
S1.004	50.00	6.08	16.289	0.350	0.0	0.0	0.0	1.40	395.3	47.4
S1.005	50.00	6.31	16.194	0.406	0.0	0.0	0.0	1.40	395.6	55.0
S1.006	50.00	6.89	16.129	0.509	0.0	0.0	0.0	1.40	396.0	69.0
S1.007	50.00	6.97	15.968	0.565	0.0	0.0	0.0	3.23	914.4	76.5
S2.000	50.00	5.26	17.686	0.044	0.0	0.0	0.0	1.71	68.2	6.0
S2.001	50.00	5.83	17.148	0.141	0.0	0.0	0.0	1.63	115.2	19.1

JNP Group		Page 2
The Innovation Centre Queens Meadow Business Park Hartlepool, TS25 5TG	Rev C Drainage Strategy Check Angmering	
Date 29/07/2022 File Drainage Calcs Split Network.MDX	Designed by BID Checked by CC	
Innovyze	Network 2020.1	

Network Design Table for Storm with Commercial Area included

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
S2.002	22.274	0.263	84.7	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit		☐
S2.003	16.575	0.310	53.5	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit		☐
S1.008	53.046	1.254	42.3	0.096	0.00	0.0	0.600	o	600	Pipe/Conduit		☐
S1.009	9.763	0.217	45.0	0.103	0.00	0.0	0.600	o	450	Pipe/Conduit		☐
S3.000	45.095	0.711	63.4	0.149	5.00	0.0	0.600	o	450	Pipe/Conduit		☐
S4.000	30.376	0.068	446.7	0.151	5.00	0.0	0.600	o	825	Pipe/Conduit		☐
S3.001	42.166	0.094	448.6	0.000	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S3.002	21.503	0.048	448.0	0.107	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S5.000	30.975	0.310	100.0	0.109	5.00	0.0	0.600	o	225	Pipe/Conduit		☐
S1.010	16.714	0.037	451.7	0.040	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.011	49.282	0.110	448.0	0.160	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.012	28.111	0.062	453.4	0.106	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.013	29.233	0.140	208.8	0.062	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.014	16.089	0.054	297.9	0.015	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.015	13.557	0.045	301.3	0.099	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S1.016	32.127	0.256	125.5	0.000	0.00	0.0	0.600	o	825	Pipe/Conduit		☐
S6.000	28.467	0.642	44.3	0.137	5.00	0.0	0.600	o	450	Pipe/Conduit		☐
S6.001	28.467	0.642	44.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit		☐
S6.002	56.214	1.296	43.4	0.059	0.00	0.0	0.600	o	450	Pipe/Conduit		☐

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.002	50.00	6.04	16.558	0.193	0.0	0.0	0.0	1.71	120.8	26.1
S2.003	50.00	6.17	16.295	0.210	0.0	0.0	0.0	2.15	152.3	28.4
S1.008	50.00	7.21	15.685	0.871	0.0	0.0	0.0	3.75	1060.7	118.0
S1.009	50.00	7.26	14.481	0.974	0.0	0.0	0.0	3.04	483.0	131.9
S3.000	50.00	5.29	12.476	0.149	0.0	0.0	0.0	2.56	406.5	20.2
S4.000	50.00	5.36	11.456	0.151	0.0	0.0	0.0	1.40	747.4	20.4
S3.001	50.00	5.87	11.390	0.300	0.0	0.0	0.0	1.40	745.8	40.6
S3.002	50.00	6.12	11.296	0.407	0.0	0.0	0.0	1.40	746.3	55.1
S5.000	50.00	5.39	14.857	0.109	0.0	0.0	0.0	1.31	52.0	14.8
S1.010	50.00	7.46	11.248	1.530	0.0	0.0	0.0	1.39	743.2	207.2
S1.011	50.00	8.05	11.211	1.690	0.0	0.0	0.0	1.40	746.3	228.9
S1.012	50.00	8.39	11.101	1.796	0.0	0.0	0.0	1.39	741.8	243.2
S1.013	50.00	8.63	11.039	1.858	0.0	0.0	0.0	2.05	1096.3	251.6
S1.014	50.00	8.78	10.899	1.873	0.0	0.0	0.0	1.71	916.7	253.6
S1.015	50.00	8.91	10.845	1.972	0.0	0.0	0.0	1.71	911.6	267.0
S1.016	50.00	9.12	10.800	1.972	0.0	0.0	0.0	2.65	1416.1	267.0
S6.000	50.00	5.16	17.684	0.137	0.0	0.0	0.0	3.06	486.6	18.6
S6.001	50.00	5.31	17.042	0.137	0.0	0.0	0.0	3.06	486.6	18.6
S6.002	50.00	5.61	16.400	0.196	0.0	0.0	0.0	3.09	492.0	26.5

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The Innovation Centre Queens Meadow Business Park Hartlepool, TS25 5TG	Rev C Drainage Strategy Check Angmering	
Date 29/07/2022	Designed by BID	
File Drainage Calcs Split Network.MDX	Checked by CC	
Innovyze	Network 2020.1	

Network Design Table for Storm with Commercial Area included

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.000	60.132	1.336	45.0	0.151	5.00	0.0	0.600	o	300	Pipe/Conduit	
S6.003	19.322	0.429	45.0	0.256	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	53.922	0.144	374.5	0.370	5.00	0.0	0.600	o	450	Pipe/Conduit	
S8.001	32.892	2.072	15.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S9.000	26.647	0.266	100.2	0.106	5.00	0.0	0.600	o	300	Pipe/Conduit	
S8.002	32.249	0.107	301.4	0.088	0.00	0.0	0.600	o	600	Pipe/Conduit	
S8.003	21.398	0.070	305.7	0.063	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.004	46.020	0.131	351.3	0.062	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.005	9.192	0.026	353.5	0.100	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.006	31.483	0.090	350.0	0.071	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.007	27.209	0.078	350.0	0.036	0.00	0.0	0.600	o	600	Pipe/Conduit	
S6.008	36.020	0.142	253.7	0.000	0.00	0.0	0.600	o	1350	Pipe/Conduit	
S10.000	31.484	0.836	37.7	0.081	5.00	0.0	0.600	o	300	Pipe/Conduit	
S6.009	63.266	0.142	445.5	0.000	0.00	0.0	0.600	o	1350	Pipe/Conduit	
S6.010	17.665	0.050	353.3	0.000	0.00	0.0	0.600	o	825	Pipe/Conduit	
S11.000	5.917	0.020	295.9	0.000	5.00	0.0	0.600	o	825	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.000	50.00	5.43	18.580	0.151	0.0	0.0	0.0	2.35	166.1	20.4
S6.003	50.00	5.72	15.104	0.603	0.0	0.0	0.0	3.04	482.8	81.7
S8.000	50.00	5.86	14.560	0.370	0.0	0.0	0.0	1.04	166.1	50.1
S8.001	50.00	5.95	14.206	0.370	0.0	0.0	0.0	6.13	1733.8	50.1
S9.000	50.00	5.28	12.700	0.106	0.0	0.0	0.0	1.57	111.0	14.4
S8.002	50.00	6.33	12.134	0.564	0.0	0.0	0.0	1.40	395.1	76.4
S8.003	50.00	6.59	12.027	0.627	0.0	0.0	0.0	1.39	392.3	84.9
S6.004	50.00	7.18	11.957	1.292	0.0	0.0	0.0	1.29	365.7	175.0
S6.005	50.00	7.30	11.826	1.392	0.0	0.0	0.0	1.29	364.5	188.5
S6.006	50.00	7.71	11.800	1.463	0.0	0.0	0.0	1.30	366.4	198.1
S6.007	50.00	8.06	11.710	1.499	0.0	0.0	0.0	1.30	366.4	203.0
S6.008	50.00	8.30	11.256	1.499	0.0	0.0	0.0	2.52	3607.8	203.0
S10.000	50.00	5.20	13.690	0.081	0.0	0.0	0.0	2.57	181.7	11.0
S6.009	50.00	8.85	11.114	1.580	0.0	0.0	0.0	1.90	2717.8	214.0
S6.010	50.00	9.04	10.972	1.580	0.0	0.0	0.0	1.57	841.3	214.0
S11.000	50.00	5.06	10.942	0.000	0.0	0.0	0.0	1.72	919.9	0.0

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The Innovation Centre Queens Meadow Business Park Hartlepool, TS25 5TG		Rev C Drainage Strategy Check Angmering	
Date 29/07/2022 File Drainage Calcs Split Network.MDX		Designed by BID Checked by CC	
Innovyze		Network 2020.1	

Network Design Table for Storm with Commercial Area included

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.011	16.806	0.042	400.1	0.074	0.00	0.0	0.600	o	825	Pipe/Conduit	⚙
S6.012	28.107	0.080	351.3	0.023	0.00	0.0	0.600	o	825	Pipe/Conduit	⚙
S6.013	39.608	0.256	154.7	0.000	0.00	0.0	0.600	o	825	Pipe/Conduit	⚙
S1.017	12.437	0.049	253.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	⚙

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.011	50.00	9.23	10.922	1.654	0.0	0.0	0.0	1.48	790.1	224.0
S6.012	50.00	9.52	10.880	1.677	0.0	0.0	0.0	1.58	843.6	227.1
S6.013	50.00	9.80	10.800	1.677	0.0	0.0	0.0	2.38	1274.7	227.1
S1.017	50.00	10.13	10.844	3.649	0.0	0.0	0.0	0.63	11.14	494.1

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Manhole Schedules for Storm with Commercial Area included

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	21.782	1.682	Open Manhole	1200	S1.000	20.100	150				
S2	21.344	1.605	Open Manhole	1200	S1.001	19.739	300	S1.000	19.889	150	
S3	20.339	1.909	Open Manhole	1200	S1.002	18.430	300	S1.001	18.430	300	
S4	18.855	2.524	Open Manhole	1500	S1.003	16.331	600	S1.002	16.631	300	
S5	19.007	2.718	Open Manhole	1500	S1.004	16.289	600	S1.003	16.289	600	
S6	19.299	3.105	Open Manhole	1500	S1.005	16.194	600	S1.004	16.194	600	
S7	18.913	2.784	Open Manhole	1500	S1.006	16.129	600	S1.005	16.129	600	
S8	17.827	1.859	Open Manhole	1500	S1.007	15.968	600	S1.006	15.968	600	
S9	18.986	1.300	Open Manhole	1200	S2.000	17.686	225				
S10	18.285	2.147	Open Manhole	1200	S2.001	17.148	300	S2.000	17.223	225	
S11	18.005	1.447	Open Manhole	1200	S2.002	16.558	300	S2.001	16.558	300	
S12	17.720	1.425	Open Manhole	1200	S2.003	16.295	300	S2.002	16.295	300	
S13	17.465	1.780	Open Manhole	1500	S1.008	15.685	600	S1.007	15.685	600	
								S2.003	15.985	300	
S14	16.281	1.850	Open Manhole	1500	S1.009	14.431	450	S1.008	14.431	600	
S15	14.126	1.650	Open Manhole	1350	S3.000	12.476	450				
S16	13.600	2.142	Open Manhole	2100	S4.000	11.458	825				
S17	13.593	2.203	Open Manhole	2100	S3.001	11.390	825	S3.000	11.765	450	
								S4.000	11.390	825	
S18	15.215	3.919	Open Manhole	1800	S3.002	11.296	825	S3.001	11.296	825	
S19	16.382	1.425	Open Manhole	1200	S5.000	14.957	225				
S20	16.068	4.820	Open Manhole	2400	S1.010	11.248	825	S1.009	14.214	450	2591
								S3.002	11.248	825	
								S5.000	14.647	225	2799
S21	15.688	4.477	Open Manhole	2100	S1.011	11.211	825	S1.010	11.211	825	
S22	14.579	3.478	Open Manhole	1800	S1.012	11.101	825	S1.011	11.101	825	
S23	13.961	2.922	Open Manhole	1800	S1.013	11.039	825	S1.012	11.039	825	
S24	13.356	2.487	Open Manhole	2100	S1.014	10.899	825	S1.013	10.899	825	
S25	13.265	2.420	Open Manhole	2100	S1.015	10.845	825	S1.014	10.845	825	
S26	13.350	2.550	Open Manhole	1800	S1.016	10.800	825	S1.015	10.800	825	
S27	19.609	1.925	Open Manhole	1350	S6.000	17.684	450				
S28	19.775	2.733	Open Manhole	1350	S6.001	17.042	450	S6.000	17.042	450	
S29	19.600	2.600	Open Manhole	1350	S6.002	16.400	450	S6.001	16.400	450	
S30	18.090	1.500	Open Manhole	1200	S7.000	16.590	300				
S31	17.436	2.332	Open Manhole	1350	S6.003	15.104	450	S6.002	15.104	450	
								S7.000	15.254	300	
S32	16.000	1.500	Open Manhole	1350	S8.000	14.500	450				
S33	16.000	1.794	Open Manhole	1500	S8.001	14.206	600	S8.000	14.356	450	
S34	15.500	2.600	Open Manhole	1500	S9.000	12.700	300				
S35	15.200	3.066	Open Manhole	1500	S8.002	12.134	600	S8.001	12.134	600	
								S9.000	12.434	300	
S36	16.287	4.260	Open Manhole	1500	S8.003	12.027	600	S8.002	12.027	600	
S37	16.901	4.944	Open Manhole	1500	S6.004	11.957	600	S6.003	14.675	450	2568
								S8.003	11.957	600	

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Manhole Schedules for Storm with Commercial Area included

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S38	16.999	5.074	Open Manhole	1500	S6.005	11.826	600	S6.004	11.826	600	
S39	17.059	5.250	Open Manhole	1500	S6.006	11.800	600	S6.005	11.800	600	
S40	16.918	5.208	Open Manhole	1500	S6.007	11.710	600	S6.006	11.710	600	
S41	14.899	3.594	Open Manhole	2400	S6.008	11.236	1350	S6.007	11.632	600	
S42	14.453	1.453	Open Manhole	1200	S10.000	13.999	300				
S43	14.999	2.886	Open Manhole	2400	S6.009	11.114	1350	S6.008	11.114	1350	
								S10.000	12.164	300	
S44	13.999	2.528	Open Manhole	2400	S6.010	10.972	825	S6.009	10.972	1350	
S45	13.599	2.558	Open Manhole	1800	S11.000	10.942	825				
S46	13.599	2.578	Open Manhole	1800	S6.011	10.922	825	S6.010	10.922	825	
								S11.000	10.922	825	
S47	13.359	2.470	Open Manhole	1800	S6.012	10.880	825	S6.011	10.880	825	
S48	13.359	2.550	Open Manhole	1800	S6.013	10.800	825	S6.012	10.800	825	
S49	13.359	2.806	Open Manhole	1800	S1.017	10.544	150	S1.016	10.544	825	
								S6.013	10.544	825	
S	14.199	3.605	Open Manhole	0		OUTFALL		S1.017	10.495	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	506721.740	105477.145	506721.740	105477.145	Required	⊗
S2	506706.936	105479.248	506706.936	105479.248	Required	⊗
S3	506687.458	105486.525	506687.458	105486.525	Required	⊗
S4	506639.393	105466.297	506639.393	105466.297	Required	⊗
S5	506633.462	105455.312	506633.462	105455.312	Required	⊗
S6	506644.051	105428.736	506644.051	105428.736	Required	⊗
S7	506643.754	105409.191	506643.754	105409.191	Required	⊗
S8	506596.210	105400.554	506596.210	105400.554	Required	⊗
S9	506647.907	105392.740	506647.907	105392.740	Required	⊗
S10	506651.329	105365.895	506651.329	105365.895	Required	⊗

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Manhole Schedules for Storm with Commercial Area included

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S11	506596.817	105358.946	506596.817	105358.946	Required	⊗
S12	506588.473	105379.598	506588.473	105379.598	Required	⊗
S13	506581.288	105394.534	506581.288	105394.534	Required	⊗
S14	506532.108	105374.654	506532.108	105374.654	Required	⊗
S15	506542.826	105449.087	506542.826	105449.087	Required	⊗
S16	506473.323	105419.674	506473.323	105419.674	Required	⊗
S17	506501.297	105431.512	506501.297	105431.512	Required	⊗
S18	506516.887	105392.334	506516.887	105392.334	Required	⊗
S19	506534.405	105342.939	506534.405	105342.939	Required	⊗
S20	506522.814	105371.663	506522.814	105371.663	Required	⊗
S21	506506.887	105366.597	506506.887	105366.597	Required	⊗
S22	506461.193	105348.136	506461.193	105348.136	Required	⊗
S23	506435.129	105337.605	506435.129	105337.605	Required	⊗
S24	506405.959	105335.693	506405.959	105335.693	Required	⊗
S25	506404.906	105351.748	506404.906	105351.748	Required	⊗
S26	506391.355	105351.355	506391.355	105351.355	Required	⊗
S27	506656.085	105348.219	506656.085	105348.219	Required	⊗
S28	506659.685	105319.980	506659.685	105319.980	Required	⊗
S29	506663.284	105291.742	506663.284	105291.742	Required	⊗

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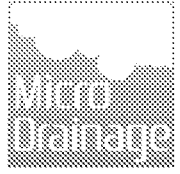
Manhole Schedules for Storm with Commercial Area included

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S30	506599.918	105344.283	506599.918	105344.283	Required	⊗
S31	506607.521	105284.634	506607.521	105284.634	Required	⊗
S32	506691.069	105226.533	506691.069	105226.533	Required	⊗
S33	506637.971	105217.142	506637.971	105217.142	Required	⊗
S34	506578.876	105210.916	506578.876	105210.916	Required	⊗
S35	506605.118	105215.544	506605.118	105215.544	Required	⊗
S36	506599.603	105247.318	506599.603	105247.318	Required	⊗
S37	506596.834	105268.536	506596.834	105268.536	Required	⊗
S38	506551.183	105262.717	506551.183	105262.717	Required	⊗
S39	506543.914	105268.343	506543.914	105268.343	Required	⊗
S40	506539.828	105299.560	506539.828	105299.560	Required	⊗
S41	506512.713	105297.309	506512.713	105297.309	Required	⊗
S42	506471.948	105321.412	506471.948	105321.412	Required	⊗
S43	506477.363	105290.397	506477.363	105290.397	Required	⊗
S44	506415.092	105279.217	506415.092	105279.217	Required	⊗
S45	506404.696	105295.401	506404.696	105295.401	Required	⊗
S46	506410.546	105296.287	506410.546	105296.287	Required	⊗
S47	506409.178	105313.038	506409.178	105313.038	Required	⊗
S48	506391.904	105335.210	506391.904	105335.210	Required	⊗

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Manhole Schedules for Storm with Commercial Area included

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S49	506360.111	105358.832	506360.111	105358.832	Required	
S	506348.248	105355.095			No Entry	

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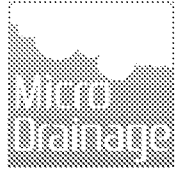
PIPELINE SCHEDULES for Storm with Commercial Area included

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	21.782	20.100	1.532	Open Manhole	1200
S1.001	o	300	S2	21.344	19.739	1.305	Open Manhole	1200
S1.002	o	300	S3	20.339	18.430	1.609	Open Manhole	1200
S1.003	o	600	S4	18.855	16.331	1.924	Open Manhole	1500
S1.004	o	600	S5	19.007	16.289	2.118	Open Manhole	1500
S1.005	o	600	S6	19.299	16.194	2.505	Open Manhole	1500
S1.006	o	600	S7	18.913	16.129	2.184	Open Manhole	1500
S1.007	o	600	S8	17.827	15.968	1.259	Open Manhole	1500
S2.000	o	225	S9	18.986	17.686	1.075	Open Manhole	1200
S2.001	o	300	S10	18.285	17.148	1.847	Open Manhole	1200
S2.002	o	300	S11	18.005	16.558	1.147	Open Manhole	1200
S2.003	o	300	S12	17.720	16.295	1.125	Open Manhole	1200
S1.008	o	600	S13	17.465	15.685	1.180	Open Manhole	1500
S1.009	o	450	S14	16.281	14.431	1.400	Open Manhole	1500
S3.000	o	450	S15	14.126	12.476	1.200	Open Manhole	1350
S4.000	o	825	S16	13.600	11.459	1.317	Open Manhole	2100
S3.001	o	825	S17	13.593	11.390	1.378	Open Manhole	2100
S3.002	o	825	S18	15.215	11.296	3.094	Open Manhole	1800
S5.000	o	225	S19	16.382	14.957	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	14.953	71.0	S2	21.344	19.889	1.305	Open Manhole	1200
S1.001	20.793	15.9	S3	20.339	18.430	1.609	Open Manhole	1200
S1.002	52.148	29.0	S4	18.855	16.631	1.924	Open Manhole	1500
S1.003	12.484	297.2	S5	19.007	16.289	2.118	Open Manhole	1500
S1.004	28.609	301.1	S6	19.299	16.194	2.505	Open Manhole	1500
S1.005	19.547	300.7	S7	18.913	16.129	2.184	Open Manhole	1500
S1.006	48.322	300.0	S8	17.827	15.968	1.259	Open Manhole	1500
S1.007	16.090	56.9	S13	17.465	15.685	1.180	Open Manhole	1500
S2.000	27.062	58.4	S10	18.285	17.223	1.847	Open Manhole	1200
S2.001	54.953	93.1	S11	18.005	16.558	1.147	Open Manhole	1200
S2.002	22.274	84.7	S12	17.720	16.295	1.125	Open Manhole	1200
S2.003	16.575	53.5	S13	17.465	15.985	1.180	Open Manhole	1500
S1.008	53.046	42.3	S14	16.281	14.431	1.250	Open Manhole	1500
S1.009	9.763	45.0	S20	16.068	14.214	1.404	Open Manhole	2400
S3.000	45.095	63.4	S17	13.593	11.765	1.378	Open Manhole	2100
S4.000	30.376	446.7	S17	13.593	11.390	1.378	Open Manhole	2100
S3.001	42.166	448.6	S18	15.215	11.296	3.094	Open Manhole	1800
S3.002	21.503	448.0	S20	16.068	11.248	3.995	Open Manhole	2400
S5.000	30.975	100.0	S20	16.068	14.647	1.195	Open Manhole	2400

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PIPELINE SCHEDULES for Storm with Commercial Area included

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.010	o	825	S20	16.068	11.248	3.995	Open Manhole	2100
S1.011	o	825	S21	15.688	11.211	3.652	Open Manhole	2100
S1.012	o	825	S22	14.579	11.101	2.653	Open Manhole	1800
S1.013	o	825	S23	13.961	11.039	2.097	Open Manhole	1800
S1.014	o	825	S24	13.386	10.899	1.662	Open Manhole	2100
S1.015	o	825	S25	13.265	10.845	1.595	Open Manhole	2100
S1.016	o	825	S26	13.359	10.800	1.725	Open Manhole	1800
S6.000	o	450	S27	19.609	17.684	1.475	Open Manhole	1350
S6.001	o	450	S28	19.775	17.042	2.283	Open Manhole	1350
S6.002	o	450	S29	19.980	16.400	2.150	Open Manhole	1350
S7.000	o	300	S30	18.090	16.990	1.200	Open Manhole	1200
S6.003	o	450	S31	17.436	15.104	1.882	Open Manhole	1350
S8.000	o	450	S32	16.000	14.500	1.050	Open Manhole	1350
S8.001	o	600	S33	16.980	14.206	1.194	Open Manhole	1500
S9.000	o	300	S34	15.900	12.700	2.300	Open Manhole	1500
S8.002	o	600	S35	15.200	12.134	2.466	Open Manhole	1500
S8.003	o	600	S36	16.287	12.027	3.660	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.010	16.714	451.7	S21	15.688	11.211	3.652	Open Manhole	2100
S1.011	49.282	448.0	S22	14.579	11.101	2.653	Open Manhole	1800
S1.012	28.111	453.4	S23	13.961	11.039	2.097	Open Manhole	1800
S1.013	29.233	208.8	S24	13.386	10.899	1.662	Open Manhole	2100
S1.014	16.089	297.9	S25	13.265	10.845	1.595	Open Manhole	2100
S1.015	13.557	301.3	S26	13.359	10.800	1.725	Open Manhole	1800
S1.016	32.127	125.5	S49	13.359	10.544	1.981	Open Manhole	1800
S6.000	28.467	44.3	S28	19.775	17.042	2.283	Open Manhole	1350
S6.001	28.467	44.3	S29	19.980	16.400	2.150	Open Manhole	1350
S6.002	56.214	43.4	S31	17.436	15.104	1.882	Open Manhole	1350
S7.000	60.132	45.0	S31	17.436	15.254	1.882	Open Manhole	1350
S6.003	19.322	45.0	S37	16.901	14.675	1.776	Open Manhole	1500
S8.000	53.922	374.5	S33	16.000	14.356	1.194	Open Manhole	1500
S8.001	32.892	15.9	S35	15.200	12.134	2.466	Open Manhole	1500
S9.000	26.647	100.2	S35	15.200	12.434	2.466	Open Manhole	1500
S8.002	32.249	301.4	S36	16.287	12.027	3.660	Open Manhole	1500
S8.003	21.398	305.7	S37	16.901	11.957	4.944	Open Manhole	1500

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PIPELINE SCHEDULES for Storm with Commercial Area included

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.004	o	600	S37	16.901	11.957	4.344	Open Manhole	1500
S6.005	o	600	S38	16.900	11.826	4.474	Open Manhole	1500
S6.006	o	600	S39	17.050	11.800	4.650	Open Manhole	1500
S6.007	o	600	S40	16.918	11.710	4.608	Open Manhole	1500
S6.008	o	1350	S41	14.850	11.250	2.244	Open Manhole	2400
S10.000	o	900	S42	14.453	13.000	1.153	Open Manhole	1200
S6.009	o	1350	S43	14.000	11.114	1.536	Open Manhole	2400
S6.010	o	825	S44	13.500	10.972	1.703	Open Manhole	2400
S11.000	o	825	S45	13.500	10.942	1.733	Open Manhole	1800
S6.011	o	825	S46	13.500	10.922	1.753	Open Manhole	1800
S6.012	o	825	S47	13.350	10.880	1.645	Open Manhole	1800
S6.013	o	825	S48	13.350	10.800	1.725	Open Manhole	1800
S1.017	o	150	S49	13.350	10.544	2.656	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S6.004	46.020	351.3	S38	16.900	11.826	4.474	Open Manhole	1500
S6.005	9.192	353.5	S39	17.050	11.800	4.650	Open Manhole	1500
S6.006	31.483	350.0	S40	16.918	11.710	4.608	Open Manhole	1500
S6.007	27.209	350.0	S41	14.850	11.632	2.618	Open Manhole	2400
S6.008	36.020	253.7	S43	14.000	11.114	1.536	Open Manhole	2400
S10.000	31.484	37.7	S43	14.000	12.164	1.536	Open Manhole	2400
S6.009	63.266	445.5	S44	13.500	10.972	1.178	Open Manhole	2400
S6.010	17.665	353.3	S46	13.500	10.922	1.753	Open Manhole	1800
S11.000	5.917	295.9	S46	13.500	10.922	1.753	Open Manhole	1800
S6.011	16.806	400.1	S47	13.350	10.880	1.645	Open Manhole	1800
S6.012	28.107	351.3	S48	13.350	10.800	1.725	Open Manhole	1800
S6.013	39.608	154.7	S49	13.350	10.544	1.981	Open Manhole	1800
S1.017	12.437	253.8	S	14.100	10.495	3.455	Open Manhole	0

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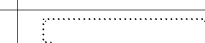
Setting Out Information - True Coordinates (Storm with Commercial Area included)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.000	S1	1200		506721.740	105477.145	506721.740	105477.145	●
S1.001	S2	1200		506706.936	105479.248	506706.936	105479.248	●
S1.002	S3	1200		506687.458	105486.525	506687.458	105486.525	●
S1.003	S4	1500		506639.393	105466.297	506639.393	105466.297	●
S1.004	S5	1500		506633.462	105455.312	506633.462	105455.312	●
S1.005	S6	1500		506644.051	105428.736	506644.051	105428.736	●
S1.006	S7	1500		506643.754	105409.191	506643.754	105409.191	●
S1.007	S8	1500		506596.210	105400.554	506596.210	105400.554	●
S2.000	S9	1200		506647.907	105392.740	506647.907	105392.740	●
S2.001	S10	1200		506651.329	105365.895	506651.329	105365.895	●
S2.002	S11	1200		506596.817	105358.946	506596.817	105358.946	●
S2.003	S12	1200		506588.473	105379.598	506588.473	105379.598	●
S1.008	S13	1500		506581.288	105394.534	506581.288	105394.534	●
S1.009	S14	1500		506532.108	105374.654	506532.108	105374.654	●
S3.000	S15	1350		506542.826	105449.087	506542.826	105449.087	●
S4.000	S16	2100		506473.323	105419.674	506473.323	105419.674	●
S3.001	S17	2100		506501.297	105431.512	506501.297	105431.512	●
S3.002	S18	1800		506516.887	105392.334	506516.887	105392.334	●
S5.000	S19	1200		506534.405	105342.939	506534.405	105342.939	●

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Setting Out Information - True Coordinates (Storm with Commercial Area included)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.010	S20	2400		506522.814	105371.663	506522.814	105371.663	⊗
S1.011	S21	2100		506506.887	105366.597	506506.887	105366.597	⊗
S1.012	S22	1800		506461.193	105348.136	506461.193	105348.136	⊗
S1.013	S23	1800		506435.129	105337.605	506435.129	105337.605	⊗
S1.014	S24	2100		506405.959	105335.693	506405.959	105335.693	⊗
S1.015	S25	2100		506404.906	105351.748	506404.906	105351.748	⊗
S1.016	S26	1800		506391.355	105351.355	506391.355	105351.355	⊗
S6.000	S27	1350		506656.085	105348.219	506656.085	105348.219	⊗
S6.001	S28	1350		506659.685	105319.980	506659.685	105319.980	⊗
S6.002	S29	1350		506663.284	105291.742	506663.284	105291.742	⊗
S7.000	S30	1200		506599.918	105344.283	506599.918	105344.283	⊗
S6.003	S31	1350		506607.521	105284.634	506607.521	105284.634	⊗
S8.000	S32	1350		506691.069	105226.533	506691.069	105226.533	⊗
S8.001	S33	1500		506637.971	105217.142	506637.971	105217.142	⊗
S9.000	S34	1500		506578.876	105210.916	506578.876	105210.916	⊗
S8.002	S35	1500		506605.118	105215.544	506605.118	105215.544	⊗
S8.003	S36	1500		506599.603	105247.318	506599.603	105247.318	⊗
S6.004	S37	1500		506596.834	105268.536	506596.834	105268.536	⊗
S6.005	S38	1500		506551.183	105262.717	506551.183	105262.717	⊗

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Setting Out Information - True Coordinates (Storm with Commercial Area included)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S6.006	S39	1500		506543.914	105268.343	506543.914	105268.343	
S6.007	S40	1500		506539.828	105299.560	506539.828	105299.560	
S6.008	S41	2400		506512.713	105297.309	506512.713	105297.309	
S10.000	S42	1200		506471.948	105321.412	506471.948	105321.412	
S6.009	S43	2400		506477.363	105290.397	506477.363	105290.397	
S6.010	S44	2400		506415.092	105279.217	506415.092	105279.217	
S11.000	S45	1800		506404.696	105295.401	506404.696	105295.401	
S6.011	S46	1800		506410.546	105296.287	506410.546	105296.287	
S6.012	S47	1800		506409.178	105313.038	506409.178	105313.038	
S6.013	S48	1800		506391.904	105335.210	506391.904	105335.210	
S1.017	S49	1800		506360.111	105358.832	506360.111	105358.832	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.017	S	0		506348.248	105355.095	

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Area Summary for Storm with Commercial Area included

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Road	100	0.033	0.033	0.033
1.001	-	-	100	0.097	0.097	0.097
1.002	-	-	100	0.048	0.048	0.048
1.003	-	-	100	0.024	0.024	0.024
1.004	-	-	100	0.148	0.148	0.148
1.005	-	-	100	0.056	0.056	0.056
1.006	-	-	100	0.103	0.103	0.103
1.007	-	-	100	0.056	0.056	0.056
2.000	-	-	100	0.044	0.044	0.044
2.001	-	-	100	0.097	0.097	0.097
2.002	-	-	100	0.052	0.052	0.052
2.003	-	-	100	0.017	0.017	0.017
1.008	-	-	100	0.096	0.096	0.096
1.009	-	-	100	0.103	0.103	0.103
3.000	-	-	100	0.149	0.149	0.149
4.000	-	-	100	0.151	0.151	0.151
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.107	0.107	0.107
5.000	-	-	100	0.109	0.109	0.109
1.010	-	-	100	0.040	0.040	0.040
1.011	-	-	100	0.160	0.160	0.160
1.012	-	-	100	0.106	0.106	0.106
1.013	-	-	100	0.062	0.062	0.062
1.014	Classification	Road	100	0.015	0.015	0.015
1.015	-	-	100	0.099	0.099	0.099
1.016	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.137	0.137	0.137
6.001	-	-	100	0.000	0.000	0.000
6.002	-	-	100	0.059	0.059	0.059
7.000	-	-	100	0.151	0.151	0.151
6.003	-	-	100	0.256	0.256	0.256
8.000	-	-	100	0.370	0.370	0.370
8.001	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.106	0.106	0.106
8.002	-	-	100	0.088	0.088	0.088
8.003	-	-	100	0.063	0.063	0.063
6.004	-	-	100	0.062	0.062	0.062
6.005	-	-	100	0.100	0.100	0.100
6.006	-	-	100	0.071	0.071	0.071
6.007	-	-	100	0.036	0.036	0.036
6.008	-	-	100	0.000	0.000	0.000
10.000	-	-	100	0.081	0.081	0.081
6.009	-	-	100	0.000	0.000	0.000
6.010	-	-	100	0.000	0.000	0.000
11.000	-	-	100	0.000	0.000	0.000
6.011	-	-	100	0.074	0.074	0.074
6.012	Classification	Homes no UC	100	0.014	0.014	0.014
	Classification	Homes no UC	100	0.009	0.009	0.023
6.013	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.649	3.649	3.649

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Surcharged Outfall Details for Storm with Commercial Area included

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.017	S	14.100	10.495	0.000	0	0
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Datum (m) 11.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	0.600	46	0.600	91	0.600	136	0.600	181	0.600	226	0.600	271	0.600
2	0.600	47	0.600	92	0.600	137	0.600	182	0.600	227	0.600	272	0.600
3	0.600	48	0.600	93	0.600	138	0.600	183	0.600	228	0.600	273	0.600
4	0.600	49	0.600	94	0.600	139	0.600	184	0.600	229	0.600	274	0.600
5	0.600	50	0.600	95	0.600	140	0.600	185	0.600	230	0.600	275	0.600
6	0.600	51	0.600	96	0.600	141	0.600	186	0.600	231	0.600	276	0.600
7	0.600	52	0.600	97	0.600	142	0.600	187	0.600	232	0.600	277	0.600
8	0.600	53	0.600	98	0.600	143	0.600	188	0.600	233	0.600	278	0.600
9	0.600	54	0.600	99	0.600	144	0.600	189	0.600	234	0.600	279	0.600
10	0.600	55	0.600	100	0.600	145	0.600	190	0.600	235	0.600	280	0.600
11	0.600	56	0.600	101	0.600	146	0.600	191	0.600	236	0.600	281	0.600
12	0.600	57	0.600	102	0.600	147	0.600	192	0.600	237	0.600	282	0.600
13	0.600	58	0.600	103	0.600	148	0.600	193	0.600	238	0.600	283	0.600
14	0.600	59	0.600	104	0.600	149	0.600	194	0.600	239	0.600	284	0.600
15	0.600	60	0.600	105	0.600	150	0.600	195	0.600	240	0.600	285	0.600
16	0.600	61	0.600	106	0.600	151	0.600	196	0.600	241	0.600	286	0.600
17	0.600	62	0.600	107	0.600	152	0.600	197	0.600	242	0.600	287	0.600
18	0.600	63	0.600	108	0.600	153	0.600	198	0.600	243	0.600	288	0.600
19	0.600	64	0.600	109	0.600	154	0.600	199	0.600	244	0.600	289	0.600
20	0.600	65	0.600	110	0.600	155	0.600	200	0.600	245	0.600	290	0.600
21	0.600	66	0.600	111	0.600	156	0.600	201	0.600	246	0.600	291	0.600
22	0.600	67	0.600	112	0.600	157	0.600	202	0.600	247	0.600	292	0.600
23	0.600	68	0.600	113	0.600	158	0.600	203	0.600	248	0.600	293	0.600
24	0.600	69	0.600	114	0.600	159	0.600	204	0.600	249	0.600	294	0.600
25	0.600	70	0.600	115	0.600	160	0.600	205	0.600	250	0.600	295	0.600
26	0.600	71	0.600	116	0.600	161	0.600	206	0.600	251	0.600	296	0.600
27	0.600	72	0.600	117	0.600	162	0.600	207	0.600	252	0.600	297	0.600
28	0.600	73	0.600	118	0.600	163	0.600	208	0.600	253	0.600	298	0.600
29	0.600	74	0.600	119	0.600	164	0.600	209	0.600	254	0.600	299	0.600
30	0.600	75	0.600	120	0.600	165	0.600	210	0.600	255	0.600	300	0.600
31	0.600	76	0.600	121	0.600	166	0.600	211	0.600	256	0.600	301	0.600
32	0.600	77	0.600	122	0.600	167	0.600	212	0.600	257	0.600	302	0.600
33	0.600	78	0.600	123	0.600	168	0.600	213	0.600	258	0.600	303	0.600
34	0.600	79	0.600	124	0.600	169	0.600	214	0.600	259	0.600	304	0.600
35	0.600	80	0.600	125	0.600	170	0.600	215	0.600	260	0.600	305	0.600
36	0.600	81	0.600	126	0.600	171	0.600	216	0.600	261	0.600	306	0.600
37	0.600	82	0.600	127	0.600	172	0.600	217	0.600	262	0.600	307	0.600
38	0.600	83	0.600	128	0.600	173	0.600	218	0.600	263	0.600	308	0.600
39	0.600	84	0.600	129	0.600	174	0.600	219	0.600	264	0.600	309	0.600
40	0.600	85	0.600	130	0.600	175	0.600	220	0.600	265	0.600	310	0.600
41	0.600	86	0.600	131	0.600	176	0.600	221	0.600	266	0.600	311	0.600
42	0.600	87	0.600	132	0.600	177	0.600	222	0.600	267	0.600	312	0.600
43	0.600	88	0.600	133	0.600	178	0.600	223	0.600	268	0.600	313	0.600
44	0.600	89	0.600	134	0.600	179	0.600	224	0.600	269	0.600	314	0.600
45	0.600	90	0.600	135	0.600	180	0.600	225	0.600	270	0.600	315	0.600

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Simulation Criteria for Storm with Commercial Area included

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB 506538 105326 TQ 06538 05326		Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for Storm with Commercial Area included

Hydro-Brake® Optimum Manhole: S33, DS/PN: S8.001, Volume (m³): 11.5

Unit Reference	MD-SHE-0052-1500-1600-1500
Design Head (m)	1.600
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	52
Invert Level (m)	14.356
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	1.5	Kick-Flo®	0.460	0.9
Flush-Flo™	0.228	1.0	Mean Flow over Head Range	-	1.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.1	2.000	1.7	4.000	2.3	7.000	2.9
0.200	1.0	1.000	1.2	2.200	1.7	4.500	2.4	7.500	3.0
0.300	1.0	1.200	1.3	2.400	1.8	5.000	2.5	8.000	3.1
0.400	1.0	1.400	1.4	2.600	1.9	5.500	2.6	8.500	3.2
0.500	0.9	1.600	1.5	3.000	2.0	6.000	2.7	9.000	3.3
0.600	1.0	1.800	1.6	3.500	2.1	6.500	2.8	9.500	3.4

Hydro-Brake® Optimum Manhole: S49, DS/PN: S1.017, Volume (m³): 43.6

Unit Reference	MD-SHE-0143-1210-2100-1210
Design Head (m)	2.100
Design Flow (l/s)	12.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	10.544
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	12.1	Kick-Flo®	1.275	9.6
Flush-Flo™	0.624	12.1	Mean Flow over Head Range	-	10.6

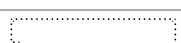
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	0.300	11.0	0.500	12.0	0.800	11.9	1.200	10.3
0.200	9.9	0.400	11.7	0.600	12.1	1.000	11.4	1.400	10.0

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Hydro-Brake® Optimum Manhole: S49, DS/PN: S1.017, Volume (m³): 43.6

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.600	10.6	2.400	12.9	4.000	16.4	6.000	19.9	8.000	22.9
1.800	11.2	2.600	13.4	4.500	17.4	6.500	20.7	8.500	23.6
2.000	11.8	3.000	14.3	5.000	18.3	7.000	21.5	9.000	24.2
2.200	12.4	3.500	15.4	5.500	19.1	7.500	22.2	9.500	24.9

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Storage Structures for Storm with Commercial Area included

Cellular Storage Manhole: S33, DS/PN: S8.001

Invert Level (m) 14.356 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	400.0	0.0	1.000	400.0	0.0	1.010	0.0	0.0

Cellular Storage Manhole: S45, DS/PN: S11.000

Invert Level (m) 10.942 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	448.0	0.0	1.600	448.0	0.0	1.610	0.0	0.0

Tank or Pond Manhole: S49, DS/PN: S1.017

Invert Level (m) 10.800

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	532.0	2.500	1744.6

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

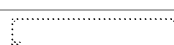
Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 506538 105326 TQ 06538 05326 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

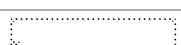
WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Summer	2	+0%	100/15 Summer				20.164	-0.086	0.000
S1.001	S2	15 Summer	2	+0%					19.804	-0.235	0.000
S1.002	S3	15 Summer	2	+0%					18.515	-0.215	0.000
S1.003	S4	15 Summer	2	+0%	100/15 Summer				16.506	-0.426	0.000
S1.004	S5	15 Summer	2	+0%	100/15 Summer				16.480	-0.409	0.000
S1.005	S6	15 Summer	2	+0%	100/15 Summer				16.401	-0.394	0.000
S1.006	S7	15 Summer	2	+0%	100/15 Summer				16.339	-0.390	0.000
S1.007	S8	15 Summer	2	+0%	100/15 Summer				16.141	-0.427	0.000
S2.000	S9	15 Summer	2	+0%	100/15 Summer				17.745	-0.166	0.000
S2.001	S10	15 Summer	2	+0%	100/15 Summer				17.251	-0.197	0.000
S2.002	S11	15 Summer	2	+0%	100/15 Summer				16.680	-0.178	0.000
S2.003	S12	15 Summer	2	+0%	100/15 Summer				16.409	-0.186	0.000
S1.008	S13	15 Summer	2	+0%	100/15 Summer				15.846	-0.439	0.000
S1.009	S14	15 Summer	2	+0%	30/15 Summer				14.692	-0.189	0.000
S3.000	S15	15 Summer	2	+0%	100/15 Summer				12.567	-0.359	0.000
S4.000	S16	15 Summer	2	+0%	30/15 Summer				11.751	-0.532	0.000
S3.001	S17	15 Summer	2	+0%	100/15 Summer				11.741	-0.474	0.000
S3.002	S18	15 Summer	2	+0%	30/30 Summer				11.710	-0.411	0.000
S5.000	S19	15 Summer	2	+0%	30/15 Summer				15.070	-0.112	0.000
S1.010	S20	15 Summer	2	+0%	30/15 Summer				11.697	-0.376	0.000
S1.011	S21	480 Summer	2	+0%	30/360 Winter				11.659	-0.377	0.000
S1.012	S22	480 Winter	2	+0%	30/120 Summer				11.636	-0.290	0.000
S1.013	S23	480 Winter	2	+0%	30/120 Summer				11.624	-0.240	0.000
S1.014	S24	480 Winter	2	+0%	30/60 Summer				11.615	-0.109	0.000
S1.015	S25	480 Winter	2	+0%	30/30 Summer				11.602	-0.068	0.000

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm
with Commercial Area included

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
				Time (mins)	Flow (l/s)		
S1.000	S1	0.38			7.3	OK	
S1.001	S2	0.10			25.5	OK	
S1.002	S3	0.17			34.1	OK	
S1.003	S4	0.14			38.5	OK	
S1.004	S5	0.20			65.1	OK	
S1.005	S6	0.25			73.3	OK	
S1.006	S7	0.26			89.5	OK	
S1.007	S8	0.18			97.1	OK	
S2.000	S9	0.15			9.6	OK	
S2.001	S10	0.25			27.3	OK	
S2.002	S11	0.35			36.8	OK	
S2.003	S12	0.31			40.0	OK	
S1.008	S13	0.16			149.8	OK	
S1.009	S14	0.63			165.5	OK	
S3.000	S15	0.09			32.6	OK	
S4.000	S16	0.05			29.9	OK	
S3.001	S17	0.07			44.8	OK	
S3.002	S18	0.11			56.9	OK	
S5.000	S19	0.49			23.8	OK	
S1.010	S20	0.57			239.0	OK	
S1.011	S21	0.11			71.1	OK	
S1.012	S22	0.08			46.7	OK	
S1.013	S23	0.06			46.9	OK	
S1.014	S24	0.08			45.6	OK	
S1.015	S25	0.09			47.4	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm
with Commercial Area included

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.016	S26	480 Winter	2	+0%	30/30 Summer				11.594	-0.031	0.000
S6.000	S27	15 Summer	2	+0%					17.764	-0.370	0.000
S6.001	S28	15 Summer	2	+0%					17.122	-0.370	0.000
S6.002	S29	15 Summer	2	+0%					16.492	-0.358	0.000
S7.000	S30	15 Summer	2	+0%	100/15 Summer				16.683	-0.207	0.000
S6.003	S31	15 Summer	2	+0%	100/15 Summer				15.283	-0.271	0.000
S8.000	S32	15 Summer	2	+0%	30/15 Summer				14.736	-0.214	0.000
S8.001	S33	960 Summer	2	+0%	30/360 Summer				14.614	-0.192	0.000
S9.000	S34	15 Summer	2	+0%	30/15 Summer				12.799	-0.201	0.000
S8.002	S35	15 Summer	2	+0%	30/15 Summer				12.377	-0.357	0.000
S8.003	S36	15 Summer	2	+0%	30/15 Summer				12.346	-0.281	0.000
S6.004	S37	15 Summer	2	+0%	30/15 Summer				12.321	-0.236	0.000
S6.005	S38	15 Summer	2	+0%	30/15 Summer				12.253	-0.173	0.000
S6.006	S39	15 Summer	2	+0%	30/15 Summer				12.151	-0.249	0.000
S6.007	S40	15 Summer	2	+0%	30/15 Summer				12.059	-0.251	0.000
S6.008	S41	480 Winter	2	+0%	100/240 Summer				11.592	-1.014	0.000
S10.000	S42	15 Summer	2	+0%					13.066	-0.234	0.000
S6.009	S43	480 Winter	2	+0%	100/240 Summer				11.592	-0.872	0.000
S6.010	S44	480 Winter	2	+0%	30/120 Summer				11.591	-0.206	0.000
S11.000	S45	480 Winter	2	+0%	30/120 Summer				11.590	-0.177	0.000
S6.011	S46	480 Winter	2	+0%	30/120 Summer				11.591	-0.156	0.000
S6.012	S47	480 Winter	2	+0%	30/120 Summer				11.589	-0.116	0.000
S6.013	S48	480 Winter	2	+0%	30/60 Summer				11.587	-0.038	0.000
S1.017	S49	360 Winter	2	+0%	2/15 Summer				11.594	0.890	0.000

PN	US/MH Name	Flow / Cap.	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.016	S26	0.05		46.7	OK	
S6.000	S27	0.07		30.3	OK	
S6.001	S28	0.07		30.0	OK	
S6.002	S29	0.09		40.8	OK	
S7.000	S30	0.21		33.0	OK	
S6.003	S31	0.33		120.6	OK	
S8.000	S32	0.54		81.4	OK	
S8.001	S33	0.00	975	1.0	OK	
S9.000	S34	0.23		23.2	OK	
S8.002	S35	0.12		37.7	OK	
S8.003	S36	0.14		43.4	OK	
S6.004	S37	0.51		162.6	OK	
S6.005	S38	0.85		174.4	OK	
S6.006	S39	0.61		182.8	OK	
S6.007	S40	0.64		186.9	OK	
S6.008	S41	0.01		33.0	OK	
S10.000	S42	0.11		17.9	OK	
S6.009	S43	0.02		34.6	OK	
S6.010	S44	0.06		31.6	OK	
S11.000	S45	0.01		3.0	OK	
S6.011	S46	0.02		11.1	OK	
S6.012	S47	0.02		11.0	OK	
S6.013	S48	0.01		10.1	OK	
S1.017	S49	1.19		12.9	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 1.000
Site Location GB 506538 105326 TQ 06538 05326 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Summer	30	+0%	100/15 Summer				20.205	-0.045	0.000
S1.001	S2	15 Summer	30	+0%					19.847	-0.192	0.000
S1.002	S3	15 Summer	30	+0%					18.578	-0.153	0.000
S1.003	S4	15 Summer	30	+0%	100/15 Summer				16.665	-0.266	0.000
S1.004	S5	15 Summer	30	+0%	100/15 Summer				16.647	-0.243	0.000
S1.005	S6	15 Summer	30	+0%	100/15 Summer				16.574	-0.221	0.000
S1.006	S7	15 Summer	30	+0%	100/15 Summer				16.513	-0.217	0.000
S1.007	S8	15 Summer	30	+0%	100/15 Summer				16.271	-0.297	0.000
S2.000	S9	15 Summer	30	+0%	100/15 Summer				17.776	-0.135	0.000
S2.001	S10	15 Summer	30	+0%	100/15 Summer				17.330	-0.118	0.000
S2.002	S11	15 Summer	30	+0%	100/15 Summer				16.789	-0.069	0.000
S2.003	S12	15 Summer	30	+0%	100/15 Summer				16.507	-0.088	0.000
S1.008	S13	15 Summer	30	+0%	100/15 Summer				15.964	-0.321	0.000
S1.009	S14	15 Summer	30	+0%	30/15 Summer				15.273	-0.382	0.000
S3.000	S15	15 Summer	30	+0%	100/15 Summer				12.612	-0.314	0.000
S4.000	S16	15 Summer	30	+0%	30/15 Summer				12.285	0.002	0.000
S3.001	S17	120 Summer	30	+0%	100/15 Summer				12.215	0.000	0.000
S3.002	S18	30 Summer	30	+0%	30/30 Summer				12.123	0.002	0.000
S3.003	S19	15 Summer	30	+0%	30/15 Summer				15.213	-0.037	0.000
S1.010	S20	15 Summer	30	+0%	30/15 Summer				12.075	-0.092	0.000
S1.011	S21	480 Winter	30	+0%	30/360 Winter				12.071	0.035	0.000
S1.012	S22	480 Winter	30	+0%	30/120 Summer				12.066	0.140	0.000
S1.013	S23	480 Winter	30	+0%	30/120 Summer				12.062	0.198	0.000
S1.014	S24	480 Winter	30	+0%	30/60 Summer				12.057	0.333	0.000
S1.015	S25	480 Winter	30	+0%	30/30 Summer				12.053	0.383	0.000

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm
with Commercial Area included

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.82			16.1	OK	
S1.001	S2	0.28			68.5	OK	
S1.002	S3	0.48			94.4	OK	
S1.003	S4	0.40			106.4	OK	
S1.004	S5	0.56			178.0	OK	
S1.005	S6	0.69			204.8	OK	
S1.006	S7	0.70			241.4	OK	
S1.007	S8	0.50			264.5	OK	
S2.000	S9	0.33			21.1	OK	
S2.001	S10	0.66			71.4	OK	
S2.002	S11	0.92			97.7	OK	
S2.003	S12	0.82			106.6	OK	
S1.008	S13	0.43			402.2	OK	
~~S1.009~~	~~S14~~	~~1.68~~			~~440.1~~	~~SURCHARGED~~	
S3.000	S15	0.20			71.4	OK	
S4.000	S16	0.11			59.5	SURCHARGED	
S3.001	S17	0.10			57.6	OK	
S3.002	S18	0.23			119.9	SURCHARGED	
~~S5.000~~	~~S19~~	~~1.07~~			~~51.8~~	~~SURCHARGED~~	
~~S1.010~~	~~S20~~	~~1.40~~			~~582.6~~	~~SURCHARGED~~	
S1.011	S21	0.13			79.7	SURCHARGED	
S1.012	S22	0.15			84.7	SURCHARGED	
S1.013	S23	0.11			87.6	SURCHARGED	
S1.014	S24	0.15			86.9	SURCHARGED	
S1.015	S25	0.16			91.0	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.016	S26	480 Winter	30	+0%	30/30 Summer				12.050	0.425
S6.000	S27	15 Summer	30	+0%					17.804	-0.330
S6.001	S28	15 Summer	30	+0%					17.162	-0.330
S6.002	S29	15 Summer	30	+0%					16.542	-0.308
S7.000	S30	15 Summer	30	+0%	100/15 Summer				16.734	-0.156
S6.003	S31	15 Summer	30	+0%	100/15 Summer				15.421	-0.133
S8.000	S32	15 Summer	30	+0%	30/15 Summer				14.987	0.037
S8.001	S33	1440 Winter	30	+0%	30/360 Summer				14.853	0.047
S9.000	S34	15 Summer	30	+0%	30/15 Summer				13.219	0.219
S8.002	S35	15 Summer	30	+0%	30/15 Summer				13.074	0.340
S8.003	S36	15 Summer	30	+0%	30/15 Summer				13.044	0.417
S6.004	S37	15 Summer	30	+0%	30/15 Summer				12.824	0.467
S6.005	S38	15 Summer	30	+0%	30/15 Summer				12.820	0.394
S6.006	S39	15 Summer	30	+0%	30/15 Summer				12.694	0.294
S6.007	S40	15 Summer	30	+0%	30/15 Summer				12.421	0.110
S6.008	S41	960 Winter	30	+0%	100/240 Summer				12.041	-0.565
S10.000	S42	15 Summer	30	+0%					13.099	-0.201
S6.009	S43	960 Winter	30	+0%	100/240 Summer				12.040	-0.424
S6.010	S44	960 Winter	30	+0%	30/120 Summer				12.039	0.242
S11.000	S45	960 Winter	30	+0%	30/120 Summer				12.039	0.272
S6.011	S46	960 Winter	30	+0%	30/120 Summer				12.039	0.292
S6.012	S47	960 Winter	30	+0%	30/120 Summer				12.038	0.333
S6.013	S48	960 Winter	30	+0%	30/60 Summer				12.038	0.413
S1.017	S49	960 Winter	30	+0%	2/15 Summer				12.928	1.344

PN	US/MH Name	Flooded		Half Drain		Pipe	Status	Level Exceeded
		Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
S1.016	S26	0.000	0.09			90.9	SURCHARGED	
S6.000	S27	0.000	0.16			66.2	OK	
S6.001	S28	0.000	0.16			65.6	OK	
S6.002	S29	0.000	0.21			96.4	OK	
S7.000	S30	0.000	0.45			71.7	OK	
S6.003	S31	0.000	0.82			303.8	OK	
S8.000	S32	0.000	1.13			172.4	SURCHARGED	
S8.001	S33	0.000	0.00			1.0	SURCHARGED	
S9.000	S34	0.000	0.46			45.9	SURCHARGED	
S8.002	S35	0.000	0.23			76.0	SURCHARGED	
S8.003	S36	0.000	0.33			98.2	SURCHARGED	
S6.004	S37	0.000	1.21			384.5	SURCHARGED	
S6.005	S38	0.000	2.05			422.4	SURCHARGED	
S6.006	S39	0.000	1.48			446.1	SURCHARGED	
S6.007	S40	0.000	1.57			460.2	SURCHARGED	
S6.008	S41	0.000	0.01			33.3	OK	
S10.000	S42	0.000	0.24			39.2	OK	
S6.009	S43	0.000	0.02			33.5	OK	
S6.010	S44	0.000	0.05			30.2	SURCHARGED	
S11.000	S45	0.000	0.01			3.3	SURCHARGED	
S6.011	S46	0.000	0.05			21.9	SURCHARGED	
S6.012	S47	0.000	0.03			21.9	SURCHARGED	
S6.013	S48	0.000	0.02			20.7	SURCHARGED	
S1.017	S49	0.000	1.20			12.1	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Data Type Point
 FEH Rainfall Version 2013 Cv (Summer) 1.000
 Site Location GB 506538 105326 TQ 06538 05326 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 45

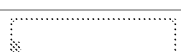
WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	S1	15 Summer	100	+45%	100/15 Summer				20.510	0.260	0.000
S1.001	S2	15 Summer	100	+45%					19.892	-0.148	0.000
S1.002	S3	15 Summer	100	+45%					18.649	-0.081	0.000
S1.003	S4	15 Summer	100	+45%	100/15 Summer				17.104	0.172	0.000
S1.004	S5	15 Summer	100	+45%	100/15 Summer				17.089	0.200	0.000
S1.005	S6	15 Summer	100	+45%	100/15 Summer				17.041	0.240	0.000
S1.006	S7	15 Summer	100	+45%	100/15 Summer				16.976	0.246	0.000
S1.007	S8	15 Summer	100	+45%	100/15 Summer				16.773	0.205	0.000
S2.000	S9	15 Summer	100	+45%	100/15 Summer				18.159	0.248	0.000
S2.001	S10	15 Summer	100	+45%	100/15 Summer				18.038	0.590	0.000
S2.002	S11	15 Summer	100	+45%	100/15 Summer				17.452	0.594	0.000
S2.003	S12	15 Summer	100	+45%	100/15 Summer				16.955	0.360	0.000
S1.008	S13	15 Summer	100	+45%	100/15 Summer				16.568	0.283	0.000
S1.009	S14	15 Summer	100	+45%	30/15 Summer				16.061	1.200	0.000
S3.000	S15	30 Summer	100	+45%	100/15 Summer				13.785	0.859	0.000
S4.000	S16	30 Summer	100	+45%	30/15 Summer				13.573	1.290	0.000
S3.001	S17	30 Summer	100	+45%	100/15 Summer				13.566	1.351	0.000
S3.002	S18	30 Summer	100	+45%	30/30 Summer				13.551	1.430	0.000
S5.000	S19	15 Summer	100	+45%	30/15 Summer				15.983	0.901	0.000
S1.010	S20	30 Summer	100	+45%	30/15 Summer				13.534	1.461	0.000
S1.011	S21	30 Summer	100	+45%	30/360 Winter				13.317	1.281	0.000
S1.012	S22	1440 Winter	100	+45%	30/120 Summer				13.069	1.143	0.000
S1.013	S23	1440 Winter	100	+45%	30/120 Summer				13.068	1.204	0.000
S1.014	S24	1440 Winter	100	+45%	30/60 Summer				13.067	1.343	0.000
S1.015	S25	1440 Winter	100	+45%	30/30 Summer				13.067	1.397	0.000

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Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	1.49			29.6	SURCHARGED	
S1.001	S2	0.51			124.0	OK	
S1.002	S3	0.87			170.5	OK	
S1.003	S4	0.68			182.2	SURCHARGED	
S1.004	S5	0.98			313.2	SURCHARGED	
S1.005	S6	1.22			350.5	SURCHARGED	
S1.006	S7	1.22			422.9	SURCHARGED	
S1.007	S8	0.80			429.0	SURCHARGED	
S2.000	S9	0.60			37.9	SURCHARGED	
S2.001	S10	1.05			114.9	SURCHARGED	
S2.002	S11	1.37			146.2	SURCHARGED	
S2.003	S12	1.19			159.7	SURCHARGED	
S1.008	S13	0.66			620.3	SURCHARGED	
S1.009	S14	2.51			658.9	FLOOD RISK	
S3.000	S15	0.32			118.4	SURCHARGED	
S4.000	S16	0.18			99.5	FLOOD RISK	
S3.001	S17	0.27			163.1	FLOOD RISK	
S3.002	S18	0.41			208.6	SURCHARGED	
S5.000	S19	1.89			91.5	SURCHARGED	
S1.010	S20	2.24			932.5	SURCHARGED	
S1.011	S21	1.61			993.7	SURCHARGED	
S1.012	S22	0.12			64.8	SURCHARGED	
S1.013	S23	0.09			66.9	SURCHARGED	
S1.014	S24	0.11			67.3	SURCHARGED	
S1.015	S25	0.13			70.7	FLOOD RISK	

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Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm with Commercial Area included

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.016	S26	1440 Winter	100	+45%	30/30 Summer				13.066	1.441
S6.000	S27	15 Summer	100	+45%					17.850	-0.284
S6.001	S28	15 Summer	100	+45%					17.208	-0.284
S6.002	S29	15 Summer	100	+45%					16.598	-0.252
S7.000	S30	15 Summer	100	+45%	100/15 Summer				16.953	0.063
S6.003	S31	15 Summer	100	+45%	100/15 Summer				16.972	0.518
S8.000	S32	15 Summer	100	+45%	30/15 Summer				15.457	0.507
S8.001	S33	1440 Winter	100	+45%	30/360 Summer				15.345	0.539
S9.000	S34	15 Summer	100	+45%	30/15 Summer				15.066	2.066
S8.002	S35	15 Summer	100	+45%	30/15 Summer				14.899	2.165
S8.003	S36	15 Summer	100	+45%	30/15 Summer				14.870	2.243
S6.004	S37	15 Summer	100	+45%	30/15 Summer				14.836	2.279
S6.005	S38	15 Summer	100	+45%	30/15 Summer				14.163	1.737
S6.006	S39	15 Summer	100	+45%	30/15 Summer				13.553	1.153
S6.007	S40	1440 Winter	100	+45%	30/15 Summer				13.068	0.758
S6.008	S41	1440 Winter	100	+45%	100/240 Summer				13.067	0.461
S10.000	S42	15 Summer	100	+45%					13.138	-0.162
S6.009	S43	1440 Winter	100	+45%	100/240 Summer				13.067	0.603
S6.010	S44	1440 Winter	100	+45%	30/120 Summer				13.067	1.270
S11.000	S45	1440 Winter	100	+45%	30/120 Summer				13.066	1.299
S6.011	S46	1440 Winter	100	+45%	30/120 Summer				13.066	1.319
S6.012	S47	1440 Winter	100	+45%	30/120 Summer				13.066	1.361
S6.013	S48	1440 Winter	100	+45%	30/60 Summer				13.065	1.440
S1.017	S49	1440 Winter	100	+45%	2/15 Summer				13.965	2.371

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.016	S26	0.000	0.07			70.5	FLOOD RISK	
S6.000	S27	0.000	0.29			121.5	OK	
S6.001	S28	0.000	0.29			120.5	OK	
S6.002	S29	0.000	0.39			177.0	OK	
S7.000	S30	0.000	0.82			129.2	SURCHARGED	
S6.003	S31	0.000	1.47			542.5	SURCHARGED	
S8.000	S32	0.000	2.05			311.6	SURCHARGED	
S8.001	S33	0.000	0.00			1.2	SURCHARGED	
S9.000	S34	0.000	0.78			78.2	FLOOD RISK	
S8.002	S35	0.000	0.44			144.9	SURCHARGED	
S8.003	S36	0.000	0.60			179.7	SURCHARGED	
S6.004	S37	0.000	2.23			708.1	SURCHARGED	
S6.005	S38	0.000	3.72			765.1	SURCHARGED	
S6.006	S39	0.000	2.66			601.5	SURCHARGED	
S6.007	S40	0.000	0.14			42.0	SURCHARGED	
S6.008	S41	0.000	0.02			41.2	SURCHARGED	
S10.000	S42	0.000	0.43			71.8	OK	
S6.009	S43	0.000	0.02			41.0	SURCHARGED	
S6.010	S44	0.000	0.07			41.0	SURCHARGED	
S11.000	S45	0.000	0.01			2.5	SURCHARGED	
S6.011	S46	0.000	0.07			33.3	SURCHARGED	
S6.012	S47	0.000	0.05			33.7	FLOOD RISK	
S6.013	S48	0.000	0.04			33.6	FLOOD RISK	
S1.017	S49	0.000	1.29			12.1	FLOOD RISK	

APPENDIX E: AUTHORITY CORRESPONDENCE

Ben Douglas

From: Paul Cann <Paul.Cann@arun.gov.uk>
Sent: 09 May 2022 13:44
To: Ben Douglas
Subject: RE: Ditch - Redrow Development - Arundel Road, Angmering

Ben

Got your voicemail, it might be best to send any queries via email as currently out on site visits for the next couple of days.

Regards

Paul Cann
Principal Drainage Engineer
Engineering Services

T: 01903 737819
E: paul.cann@arun.gov.uk



Arun District Council, Civic Centre, Maltrovers Rd, Littlehampton, West Sussex, BN17 5LF
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From: Paul Cann
Sent: 03 May 2022 15:23
To: [REDACTED]
Cc: [REDACTED]
Subject: RE: Ditch - Redrow Development - Arundel Road, Angmering

Hi Ben

Some initial comments;

1. From previous discussions, I envisaged the new ditch connecting to the existing ditch on the western boundary directly. I appreciate the slight encroachment into 3rd party land but that was always anticipated. Even if this results in obtaining the necessary permissions with the adjoining landowner.
2. The ditch outlet being piped for such a length and to an existing 100mm land drain in the SW corner would not be acceptable. Obviously, with the intention of trying to keep the works entirely within your client's land.
3. Our Parks Dept (Joe Russell-Wells) have voiced the potential issue that the proposed ditch will conflict with the proposed sports pitch layout. I am awaiting further clarification on this.
4. There could be scope to reduce the width of the proposed ditch and possibly deepen it, depending on the side slopes being achieved. At the moment, the proposal is more 'swale' like.
5. I assume the suds pond outlet will be subject to a further land drainage consent application ie. it will need to connect directly into the western boundary ditch.

The above items really need to be resolved before we can discuss this proposal in further detail.

Regards

Paul Cann
Principal Drainage Engineer
Engineering Services

T: 01903 737819
E: paul.cann@arun.gov.uk



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From: Ben Douglas [REDACTED]
Sent: 06 April 2022 16:09
To: Paul Cann <Paul.Cann@arun.gov.uk>
Cc: Simon Jane [REDACTED]
Subject: Ditch - Redrow Development - Arundel Road, Angmering

CAUTION: This email originated from outside of the organisation. You should take extra care when clicking links or opening attachments - if you are unsure the content is safe contact the IT Helpdesk before clicking or opening.

Hi Paul,

Further to discussions and site meeting with Redrow on the 18th March 2022, please find attached land drainage application and plans illustrating the proposed ditch, as well as location of the proposed infill of the recently constructed ditch on the adjacent development.

We have also attached land drainage consent application forms for

- Infill of recently formed watercourse on adjacent development.
- Removal of existing pipe crossing the site.
- Re-use of existing connection to ditch to west of site for the adoptable SW drainage

Simon – A method statement will be required from contractor, and payment of land drainage consent application fee will be needed once Paul can confirm fee required. I've attached the ecology reports from the outline planning, but aware there may be more recent ones that we do not have on our system?

If you have any queries, please do not hesitate to contact me,

Best Regards

Ben Douglas

Eng (Hons) IEng MICE
Principal Civil Engineer



JNP GROUP
CONSULTING ENGINEERS

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From: Corke, Mimi [REDACTED]
Sent: 10 February 2022
To: Simon Jane [REDACTED]
Subject: RE: SWS-SUSXW-CC-005342 - DS_CC_PPE-121619 - Land Off Arundel Road, Angmering, Littlehampton, West Sussex, BN16 4ET

=====
THIS EMAIL ORIGINATED FROM AN EXTERNAL SOURCE.
CHECK THE EMAIL ADDRESS, AS IT MAY BE SPAM!
=====

Morning Simon,

It is Southern Waters responsibility to provide the required reinforcement for the development within 24 months of when planning was granted. As mentioned previously there is the capacity to connect 135 units to our network and we will work with your build programme to ensure we have the capacity for the remaining 25 units.

Kind Regards

Mimi

Mimi Corke
Key Account Manager, Business Channels

[REDACTED]



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